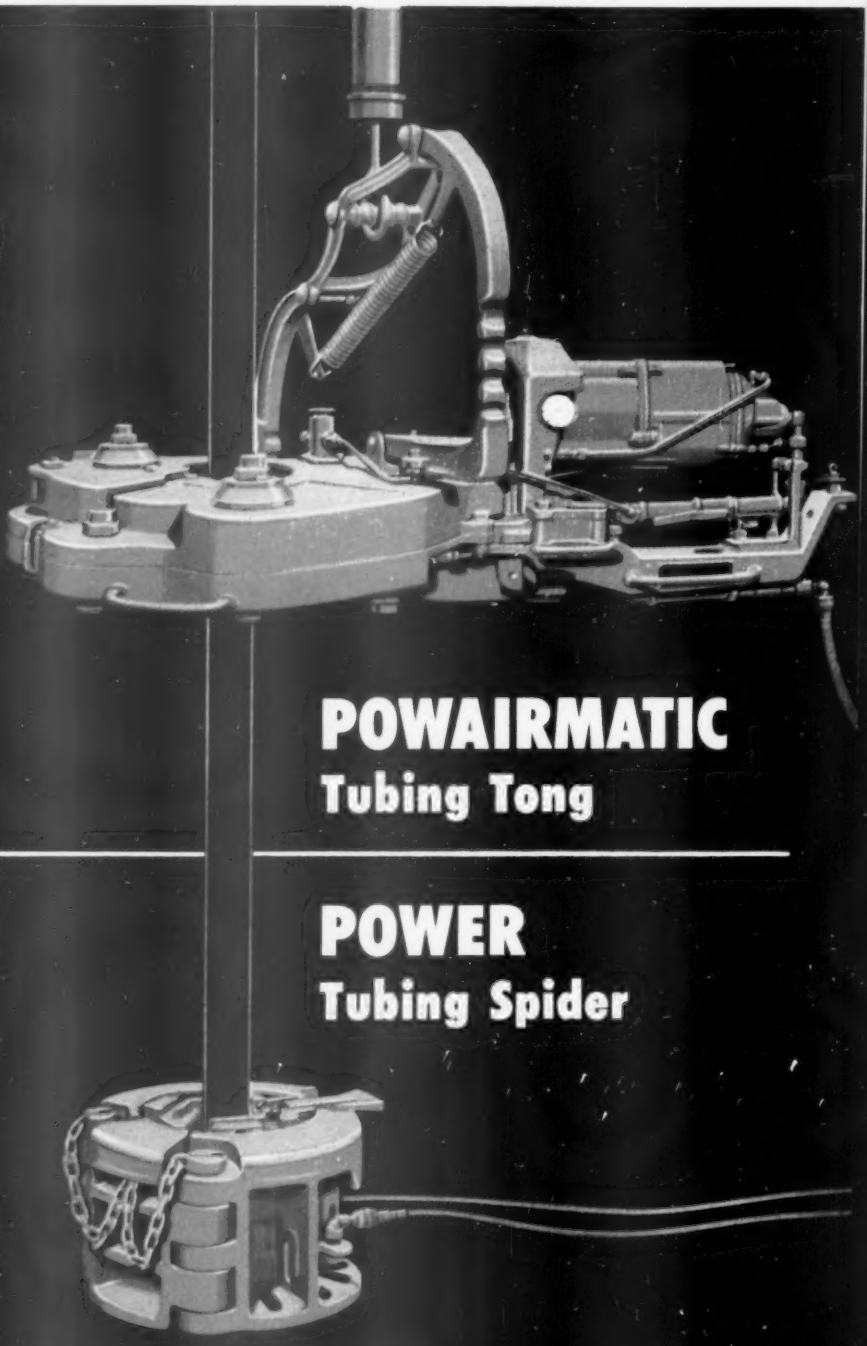
the Rocky Mountain Oil
OIL AND GAS JOURNAL

put POWER on your production work ...and SAVE!



BJ

POWAIRMATIC
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POWER
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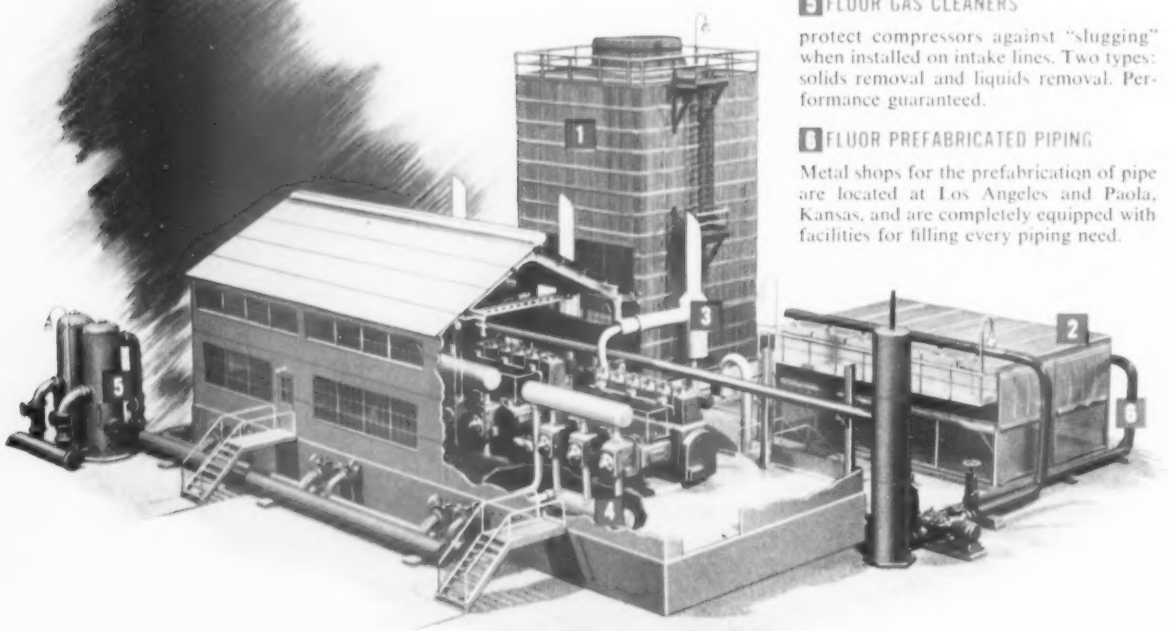
Tools of our Trade No. 7

PRICE 50 CENTS TABLE OF CONTENTS ON PAGE 1 AUGUST 31, 1953

Here's how FLUOR PRODUCTS serve gas compressor stations



1 FLUOR COUNTERFLO COOLING TOWER

is the "true economy" tower: efficient design, economical operation and maintenance, and low initial cost. Completely prefabricated.

2 FLUOR AIR COOLED FIN-FAN

cools liquids, vapors and gases at pressures up to 5,000 psi in sizes to meet any requirement, with low first cost and low operating cost.

3 FLUOR MUFFLERS

are dependable, inexpensive mufflers for 2 and 4 cycle engines, through a broad range of makes, models and horsepower ratings. Maximum noise attenuation with minimum engine back pressure.

4 FLUOR PULSATION DAMPENERS

eliminate pulsations in pipe, improve the accuracy of metering and decrease plant vibration. A Fluor Pulsation Dampening System can be installed at a cost comparable to original piping.

5 FLUOR GAS CLEANERS

protect compressors against "slugging" when installed on intake lines. Two types: solids removal and liquids removal. Performance guaranteed.

6 FLUOR PREFABRICATED PIPING

Metal shops for the prefabrication of pipe are located at Los Angeles and Paola, Kansas, and are completely equipped with facilities for filling every piping need.

This miniature compresser station which was on display at the Oil Show in Tulsa, Oklahoma, shows exactly how Fluor products and services provide a compressor station with greater efficiency. The Fluor Counterflo Coilshed Cooling Tower is cooling compressed natural gas. Engine jacket water and lube oil cooling is being performed by a Fluor Fin-Fan Air Cooled Heat Exchanger. Fluor Mufflers abate engine noise while Pulsation Dampeners convert a pulsating gas flow into a steady, even stream. Fluor Gas Cleaners on the intake side of a plant remove both solids and liquids from gas, and all units are connected with Fluor Prefabricated Piping. Fluor not only manufactures these specialized products, but also contracts for the design, construction and expansion of complete compressor stations.

Wherever oil is refined, natural gas is compressed or treated, chemicals and petrochemicals are processed, power is generated, and where large-scale manufacturing is in operation—Fluor products can perform a job for you. For information on Fluor products and engineering services contact your Fluor representative or write for Catalog RC-8523.

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the OIL AND GAS JOURNAL

AUGUST 31, 1953 VOL. 52 NO. 17

OIL IN THE NEWS . . .

Record Breaking Well Continues Coring Ahead	40
Unit Operation of Redwater Field Awaits Approval	42
California Injunction Restricts Aliso Canyon Production	43
Oil Imports Boost West Coast Stocks 17,000,000 Bbl.	43
Texas Reluctant to Sell Royalty Oil for West Coast Line	44
Last Briefs in SACROC Case Scheduled for Filing August 31	45
Construction Started on Line Between Mexico, United States	45
Natural-Gasoline Postings Make Third Jump in 2 Weeks	47
Phillips Case Appealed to Supreme Court; States Support Company	48
Oil Price Hike is Shot in the Arm to Inflation, Heselton Says	49
Eisenhower Endorses FOA Warning Against Defense Slowup	50
Bids on Military Products Line in Alaska to Be Opened October 14	51
World Crude-Oil Production Sets New All-Time Record	52
New Colombian Refinery Urged by Government Oil Committee	54
Feeling Growing That Oil Production Will Resume in Iran	56
Expanded Operations Under Way in Borneo	59
World's Biggest Oil Tanker Now Under Construction	59
National Motor-Gasoline Survey, Winter 1952-53	131

NEWS FEATURES . . .

They Say	24
Calendar of Events	29
Journally Speaking	35
Editorial	37
This Week	39
Watching Washington	50
International News	52
Personals	60
Deaths in the Industry	66
Drilling Contractors	146
Pipe-Line News	150
Natural-Gas News	157
Natural-Gasoline News	157
Refining News	159
Petrochemical News	159

ROCKY MOUNTAIN OIL*

The Rockies—A Beckoning Frontier for the American Oil Industry	69
Intermontane Basins in the Rockies—A Map	70-71
Williston—Newest Producing Basin in Rocky Mountain Area	72
Big Horn—Biggest Producing Basin in the Rockies	81
Wind River—A Geologically Complex Producing Basin	86
Powder River—Wyoming's Most Active Oil-Producing Basin	91
Denver-Julesburg—Busiest Basin in Rocky Mountain Area	95
Green River—Wyoming's Most Promising Basin for Gas Reserves	100
Uinta—Newest Intermontane Basin in Rockies	108
San Juan—Greatest Gas-Producing Basin in Rockies	113
Diamond Coring and Drilling Solve Penetration Problems	120

EXPLORATION

Rockies Are Top Future Province	163
Highlights of Week's Developments	163
Wildcat Completions Soar to New High	164
Total Completions Set Record	165
Field Reports from Oil-Producing Areas	166

DEPARTMENTS . . .

Refiner's Notebook	133
Questions on Technology	135
Equipment Men in News	137
Equipment Digest	141
Active Rotary Rigs	148
Wildcat Completions for Month	164
Total Completions for Month	165
Areal Field Reports	166
Exploration Statistics	179
Production Statistics	180
Refining Statistics	181
Market Statistics	182
Classified Advertising	183
Advertisers' Index	187

In Brief . . .

*This special section of The Oil and Gas Journal gives the reader a concise picture of eight prominent Rocky Mountain basins—their location, geology, important oil fields, current activity, drilling and production practices, outlets for oil and gas, and refineries.

The intermontane basins of the Rocky Mountains and those basins of the Great Plains immediately to the east of the Rockies offer the greatest undeveloped oil country in the United States.

The **Williston basin** is not only the newest producing basin of the Rocky Mountain province, but it is also the biggest single unit under Rocky Mountain jurisdiction. Today, only a little more than 2 years after the initial discovery in North Dakota, the United States portion of the Williston basin is producing nearly 20,000 bbl. of oil daily from 12 fields in North Dakota and Montana.

Fields of the **Big Horn basin** of Wyoming yield more than 50 per cent of the oil produced in the State of Wyoming and 30 per cent of the oil produced in the entire Rocky Mountain region. This basin has recently seen many advances in exploratory techniques.

First one area and then another has kept the **Powder River basin** of northeastern Wyoming the most active of the numerous Wyoming basins for the past few years. This big basin offers many kinds of traps and numerous favorable sands throughout a large, sparsely tested area.

A number of important fields have been developed near the margins of the **Wind River basin,** but, despite active exploration, there remains much to be learned of this geologically complex intermontane basin.

The lure of production at moderate depth, a comparatively low cost of exploratory work, and a favorable land-leasing situation, have made the **Denver-Julesburg basin** the most active in the Rocky Mountain area during the past few years.

The **Green River basin** of southwestern Wyoming is being played heavily with the thought that here is a coming rival of the gas-producing San Juan basin of Northwest New Mexico.

The **Uinta basin** of northeastern Utah, now recognized as harboring one of the outstanding undeveloped oil reserves of this country, became productive of oil in commercial quantities more recently than any other intermontane basin of the Rockies.

Current gas production in the **San Juan basin** amounts to 60 billion cubic feet annually, making this basin by far the greatest gas-producing area in the Rocky Mountain region. Gas reserves in the basin have been estimated at 15 trillion cubic feet. Exploration activity and development drilling in the San Juan basin are at an all-time high.

Why the Petroleum Industry Prefers HARTZELL Cooling Tower Fans

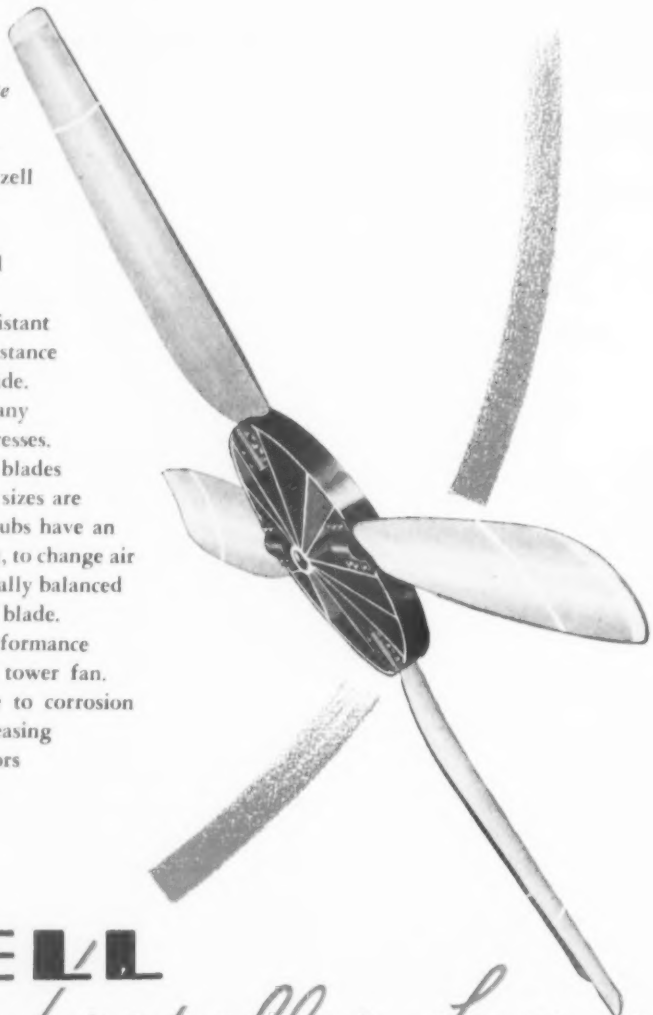
Nearly every Hartzell cooling tower fan installed since the introduction of the Hartzite plastic blade in 1941 is still in service. This proven dependability explains why the plant which has had experience with one Hartzell fan will almost invariably insist on more Hartzells as other fans need replacement.

Fabric-base Hartzite plastic was developed especially to meet the rugged requirements of the petroleum industry. It is unusually resistant to corrosion and abrasion. Durability and resistance to corrosion are constant throughout the blade. Hartzite absorbs vibration. Its strength is many times that necessary to withstand normal stresses.

Hartzell cooling tower fans with Hartzite blades are available in sizes from 10′ to 22′. Smaller sizes are made of aluminum alloy. The welded steel hubs have an extremely high safety factor. Blade adjustment, to change air delivery, is easily made. All hubs are dynamically balanced and all blades are balanced against a master blade.

You no longer have to rely on claims. Performance has proven that Hartzell makes *the* cooling tower fan. Recognition of Hartzell's superior resistance to corrosion and mechanical damage is found in the increasing frequency with which cooling tower operators specify simply "Hartzell fan."

Send for Bulletin 1503.



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PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

B. F. Goodrich grommet belts last 20 to 50% longer, yet cost no more than ordinary V belts

Save 3 ways

Here's how you can make a 3-way saving with B. F. Goodrich grommet V belts. First, you save on replacement costs because grommet V belts last 20 to 50% longer. You save on production costs because machines keep running with fewer interruptions. And you save on maintenance costs because these V belts need less attention. Here are the basic reasons BFG grommet belts outlast and outperform ordinary V belts:

Strongest V belt made

All of the load-carrying cords in grommet belts are concentrated in twin grommets. These grommets are cord loops, made like giant twisted cables except that they're endless. Since there are no center cords, the grommet belt is more flexible, and so can "give" temporarily and absorb shock loads. As a result, grommet belts last 20 to 50% longer, depending on the service. (The more severe the service, the greater the increase over ordinary belts.)

No weak spots

The section where cords overlap is the weak spot in ordinary belts. That's where 80% of V belt failures occur. But in grommet V belts this cause of belt failure has been eliminated. The grommets are endless. There are no splices or overlaps—no weak spots to cause premature belt failures.

⅓ more grip

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip sheaves better. Size for size, grommet belts give ⅓ more gripping power with less slip, pull heavier loads with a higher safety factor. And because there is less slip, there is also less surface wear.

Less stretch

In ordinary belts under tension, the center cords loaf, the outer cords overwork because tension is greater near the driving faces. Grommet belts, with no center cords, have much more strength and less stretch. Grommet belts stretch, on an average, only about ⅓ as much as ordinary belts.

They cost no more

Grommet V belts were developed by B. F. Goodrich to give V belt users more for their money. No other belt will stand so much punishment or last so long. Yet the savings they can make for you will be clear profit because grommet belts cost not one cent more than ordinary V belts.

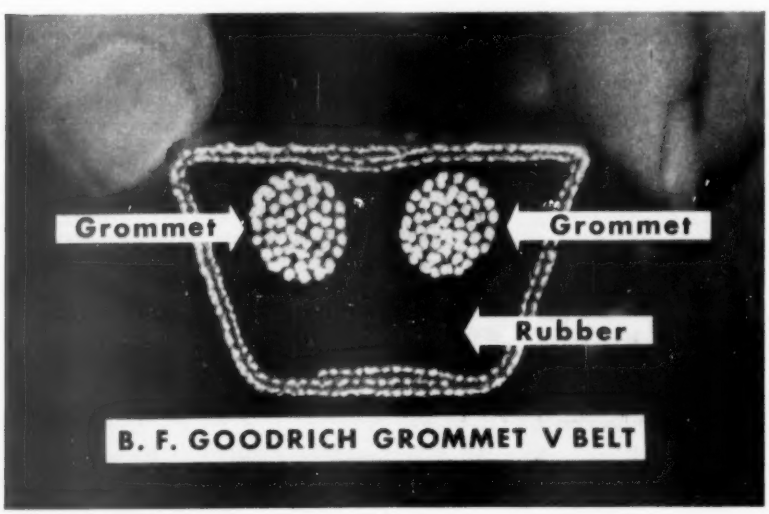
Send for proof today

Ask your local B. F. Goodrich distributor or send the coupon for a set of reports telling users' experiences and showing actual installations where grommet V belts have outlasted all others.

Grommet V-Belts BY

B.F.Goodrich

RUBBER FOR INDUSTRY



The B. F. Goodrich Company
Dept. M-94
Akron, Ohio

☐ Send set of reports telling users' experiences and showing actual installations proving that B. F. Goodrich grommet belts outlast all others.

☐ Have distributor show me the "X-ray" belt so I can see grommet belt construction.

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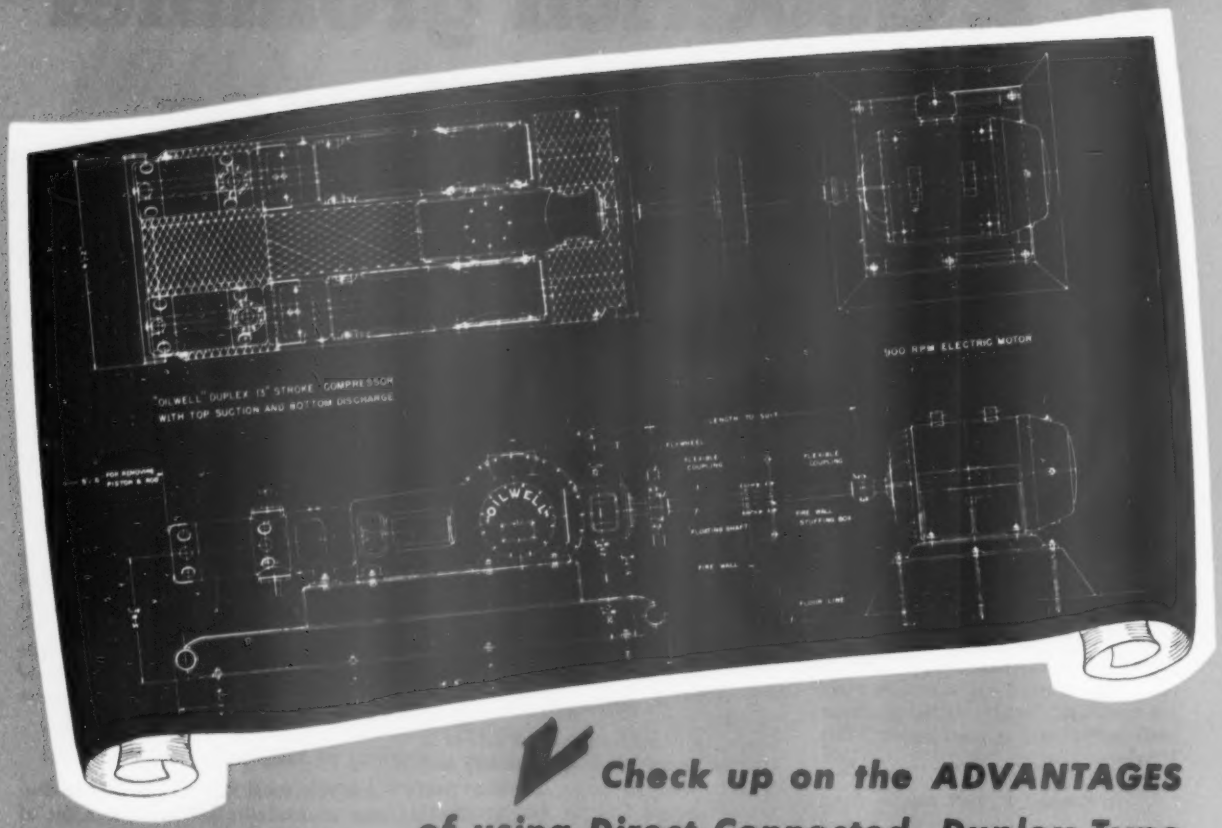
SINGLE or MULTIPLE Units!



Check up on the ADVANTAGES of using Direct-Connected, Duplex-Type

"Oilwell" Compressor Units

. . . for Gas Compression in Refineries

"OILWELL" UNITS of this type are slow speed; designed with direct drive through right-angle gears to two parallel compressors so as to utilize 300 hp. input from a single prime mover with maximum efficiency.

For applications in the larger-volume-low-pressure range, single-stage compressors can be furnished. Where higher pressures are required, multi-stage compressors can be furnished to develop discharge pressures to 3,000 p.s.i.

Installations in hazardous areas can be made with maximum safety, by incorporating a fire wall between unit and driver as indicated in the sketch.

Where gas concentrating operations exceed the capacity of a single compressor unit, multi-unit installations are highly practical because they permit the routine servicing of individual compressors when necessary without shutting down the entire operation.

Let your "Oilwell" Representative . . . quote on "Oilwell" Compressor Units to meet the gas-concentrating requirements of your refinery.

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UNITED STATES STEEL

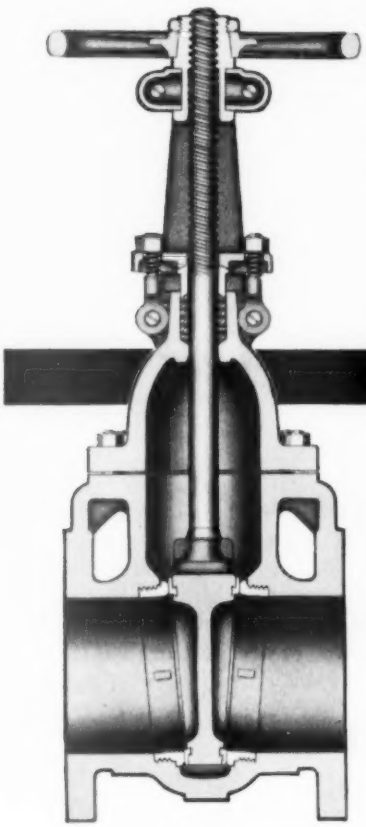
seating surfaces stay

slick as a Whistle

...in CRANE 18-8 Mo ALLOY TRIMMED ALLOY CAST IRON GATE VALVES

This is the valve that cancels out seating surface corrosion economically in many piping processes. Its seats, disc, and stem are Crane 18-8 Mo alloy steel—an exceptionally high-grade stainless steel, highly resistant to most corrosive fluids.

NOW IN SIZES UP TO 18 INCHES



Cross-Section No. 14477
Crane Alloy Cast Iron Wedge Gate
18-8 Mo Alloy Trimmed
Flanged Ends
WORKING PRESSURES: 200 pounds cold water, oil, or gas, non-shock.
Sizes: 2, 2½, 3, 4, 6, 8, 10, 12, 14, 16 and 18 in.

You'll recognize this valve pattern. It's the same as the famous Crane all-iron wedge gate, with the same liberal metal sections for maximum strength, and with tie-ribs on bonnet and end flanges for extra resistance to line strains. The big difference in these No. 14477 valves is: the body and bonnet are nickel low alloy cast iron, having much better physical properties and corrosion resistance than ordinary cast iron.

TYPICAL APPLICATIONS

In the *Petroleum* industry, these valves are giving outstanding service on oils with traces of mineral acids . . . in *Wood Treating*, on creosote vapors and oils . . . in *Pulp and Paper* processing, on alkaline liquors of various kinds. In fact, No. 14477 valves are ideal for mildly corrosive services where all-iron valves are inadequate but where it is uneconomical to use all-stainless steel valves.

A new circular on No. 14477 gives complete specifications and lists new sizes available. Write direct, or ask your Crane Representative for a copy.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
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Do you have this MARVEL Inverse Oiler on your { GASOLINE / BUTANE / or / DRY GAS } engine?

then you should use this MARVEL MYSTERY OIL in the Oiler!

Here's a carefully engineered pair to improve performance of any engine . . .

The *Marvel Inverse Oiler* is designed to feed *Marvel Mystery Oil* in exact proportion to engine speed and load. Prevents excess wear on valve stems and guides . . . keeps upper piston rings free to move in their grooves . . . retards ring flutter . . . and cushions ring pounding which can result in ring breakage. In addition, *Marvel Mystery Oil* reduces cylinder wall wear, and gives assurance against valves sticking. Remember, it is *the oil* which must do these things and only *Marvel Mystery Oil* is blended for this purpose and for this oiler. Over 30 years of exceptional performance.

This Chart shows the proper setting for constant load engines

BRAKE H. P. AT BELT	NAT. GAS CU. FT. PER HOUR	BUTANE GALLONS PER HOUR	GASOLINE GALLONS PER HOUR	M. M. OIL DROPS PER MIN.	M. M. OIL HOURS PER QUART
10	115.	1.07	1.12	4	228
15	172.5	1.60	1.68	6	152
20	230.	2.14	2.24	8	114
25	287.5	2.67	2.80	10	91
30	345.	3.21	3.36	12	76
35	402.5	3.74	3.92	14	65
40	460.	4.28	4.48	16	57
45	517.5	4.81	5.04	18	50
50	575.	5.35	5.60	20	45
60	690.	6.42	6.72	24	38
70	805.	7.49	7.84	28	32
80	920.	8.56	8.96	32	28
90	1035.	9.63	10.08	36	25
100	1150.	10.70	11.20	40	22
120	1380.	12.84	13.44	48	19
140	1610.	14.98	15.68	56	17
160	1840.	17.12	17.92	64	14
180	2070.	19.26	20.16	72	12
200	2300.	21.40	22.40	80	11
225	2587.5	24.00	25.20	90	10
250	2875.	26.75	28.00	100	9
275	3162.5	29.42	31.10	110	8
300	3450.	32.10	33.60	120	7

Chart shows total oil consumption

EXAMPLE:—If you use 805 cu. ft. of dry gas, 7.49 gallons of butane or 7.84 gallons of gasoline, your H.P. is about 70, so adjust oiler to feed 28 drops per minute. You will then receive about 32 hours per quart of MARVEL MYSTERY OIL.

If engine load increases after setting for normal load, oiler will automatically increase its feed, or decrease its feed when load is lessened.

To determine drop count per oiler when more than one oiler is used on an engine—divide recommended drop count by number of oilers.

NOTE: Guarantee on oiler is void if any other oil than MARVEL MYSTERY OIL is used therein. Some *engines* also carry this guarantee policy.

See Your Local Jobber or Oil Well Supply House

EMEROL MFG. CO. Dept. 372, 242 West 69th Street, New York 23, N. Y.

STEADY RUNNING WITH A CAT* SPREAD

WHEN the ditcher is down, an entire pipe-line operation may be disrupted. That's why a dependable Caterpillar D13000 Diesel powers this Buckeye Ditcher on a job near Greenville, Miss.

"I've been working with Cat units for the last six years," declared C. R. Ice, Superintendent for H. C. Price Co., Bartlesville, Okla. "I think they are the best because of their smooth power and steady running."

Proof of the statement is the big yellow equipment in this spread. It includes nine Caterpillar D8 Tractors, five D7s, four D315s and one D318 powering excavators, and another D13000 running a second ditcher.

Standardizing on Caterpillar pays off not only in dependability *but in cold cash.* You save money when your operators and mechanics need to know only one make of machinery. You cut costs because many parts are interchangeable between some models of Cat Engines. Expenses drop when you need only low-cost No. 2 furnace oil for fuel for your equipment.

And you build profits when you get quick, efficient, one-stop service from your Caterpillar Dealer. He's the man who can demonstrate the advantages of Cat equipment on your job. And remember that leading manufacturers of pipe-line equipment can supply Caterpillar Engines in their machines.

Caterpillar Tractor Co., Peoria, Illinois.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks — U

SPECIFY CAT POWER FOR HIGH-PROFIT PRODUCTION

TIME-TESTED
COST-SAVING
FAVORITE!

HALLIBURTON'S
RETRIEVABLE PACKER

There are really two big reasons why this Retrievable Tool continues to be a favorite in the oil fields. First, it is a proved performer in completing successful squeeze jobs under adverse conditions. And second, it does the job at a real savings in rigtime.

It's retrievable. There's no rigtime wasted in drilling out because the tool actually is retrieved about an hour after the cement has been placed.

Halliburton's Retrievable Packer is versatile. Operators have used it successfully on thousands of jobs to repair casing leaks, recement casing or liners, control unwanted water, correct channeling, and on a variety of additional remedial well jobs.

The simple design and construction of this tool belies its ability. The complete assembly consists of slip body, two packer cups, and a circulating valve. After circulating ports are closed by picking up a few feet on tubing or drill pipe, applied fluid pressure causes the hydraulic slips to engage wall of casing. As fluid pressure is increased, the slips set so firmly that normal squeeze pressures required can be applied below the Packer Cups to do the job.

OPERATIONAL DIAGRAM
OF
RETRIEVABLE PACKER

Next time you want a successful remedial squeeze job, use this effective Retrievable Packer. Save rigtime too. Call your nearby Halliburton representative. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

YEARS AHEAD IN SQUEEZE CEMENTING!

Every third Employee owns part of Standard

Meet Forrest Dickinson, a driller from Whittier, California—and one of the owners of Standard Oil Company of California. Forrest is bringing up three youngsters, buying a home, and is also building a family nest egg by investing in his Company through Standard's stock ownership plan. Forrest and other Standard Oilers who are 35 or older and have 5 years of service, may, if they wish, invest a portion of their pay in Standard shares. The Company assists by contributing a percentage of its net profit to the stock ownership plan. Thus, in addition to salary and employee benefits, Forrest shares Company earnings in two ways: through Standard's contributions to his stock purchases, and through dividends on stock. Nearly 95% of all eligible employees now participate in this plan. While several thousand previously had invested in Company shares on their own, 12,000 of a total 34,750 Standard Oilers are now shareholders. This means, of course, that better than one out of every three people who work for Standard also *own* Standard. That's why Standard Oilers work a little harder to serve you better—after all, it's *their* business, too.

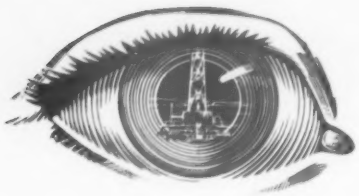
There's No Such Thing as a "typical" Standard shareholder. More than 115,000 individuals and couples from all levels of life own Standard.

Small Businesses and large believe in us, too. Our records show that 1,889 firms own shares of Standard Oil Company of California stock.

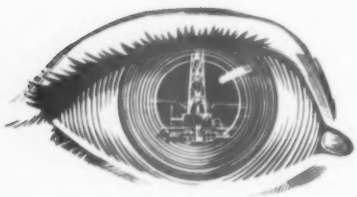
244 Churches and religious organizations, 165 hospitals and medical groups, and 293 universities and schools own part of Standard.

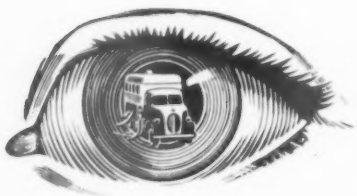
Standard's Owners are, mainly, thousands of average everyday people, most of them Westerners. Their Company's management is wholly independent. Standard Oil Company of California is neither owned nor controlled by any of the Standard companies in the East. *Questions or comments about our Company are always welcome. Write: Standard Oil Company of California, P. O. Box 3495-B, San Francisco, California.*

STANDARD OIL COMPANY OF CALIFORNIA ***plans ahead to serve you better***



drill...





with both eyes open!

Use Core Lab's Well Logging Service . . . . Each foot drilled is logged for drilling time . . . Cuttings are minutely analyzed for hydrocarbon concentration indicating oil and gas . . . Gas concentration in drilling mud is measured continuously to reduce the possibility of blowouts . . . Physical characteristics of mud (weight, viscosity, water loss) are measured each tour . . . Data on cuttings and mud are plotted versus depth for interval logged . . . Stray pays are picked up when encountered, while anticipated productive zones are pin-pointed without unnecessary "pre-coring". The same Core Lab crew and portable equipment are immediately available to perform On-Location Core Analysis at no extra charge. *Drill with both eyes open. Drill with Core Lab's Well Logging Service.*

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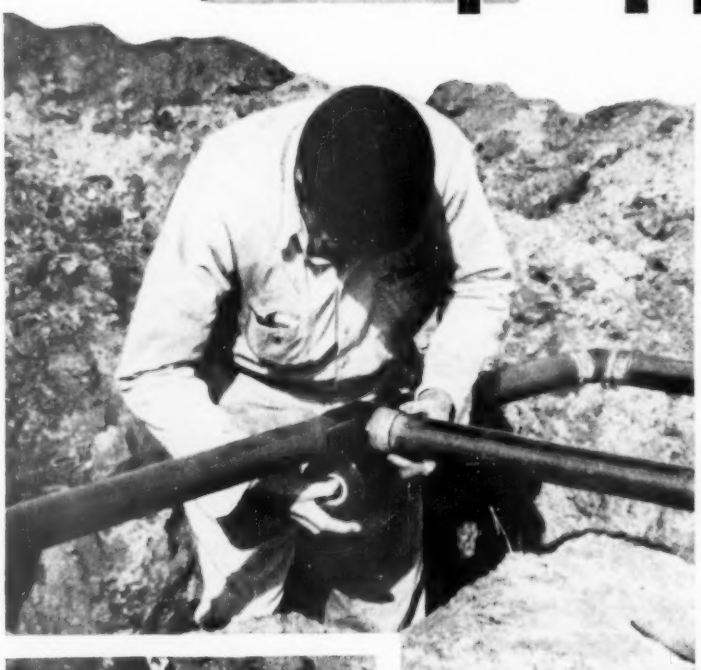
CORE LAB
WELL LOGGING SERVICE

Fight corrosion with easy 1-step application



***Polyken* Protective Tape Coatings** are ideal for use on couplings, joints and holidays. Conforms readily, goes on quickly . . . to speed the job and cut costs.

New *Polyken* Protective Tape Coatings may be applied by portable machine up to 30 feet per minute even by inexperienced workmen.

You can apply this *Polyken* pressure-sensitive tape economically by hand or machine just as it comes off the roll. Pipes are coated uniformly and evenly in one simple step. You don't have to mess with heating or mixing. There are no liquids, solvents or thinners to use . . . no cumbersome or expensive machines to operate or clean . . . and no delay for drying time.

Yet, simple as application is, *Polyken* Protective Tape Coatings can be depended upon to guard pipes against corrosion for a long, long time. And that goes for pipes in any location—above or below ground, in the plant or in the field.

Polyken Tape No. 900, black (also available in gray, No. 910) is the polyethylene plastic tape coating made by an exclusive *Polyken* process. See for yourself how your corrosion problems can be solved this easy way. Mail the coupon for free samples and details.

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PROTECTIVE COATINGS

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TAILORED TO YOUR JOB

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Please send me samples and further information on *POLYKEN* PROTECTIVE TAPE COATINGS.

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Company _____

Street Address _____

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Again!

Gas Pulsation Prevented

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BURGESS-MANNING SNUBBERS

THESE OUTSTANDING COMPANIES PLACED THEIR CONFIDENCE IN BURGESS-MANNING

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for
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Individually engineered and designed Burgess-Manning Snubbers effectively control pulsation in gas and air piping excited by compressors, blowers, or reciprocating pumps. Pulsation control prevents line vibration and equipment fatigue with improved gas flow.

Smoother gas flow allows for best efficiency,
process action,
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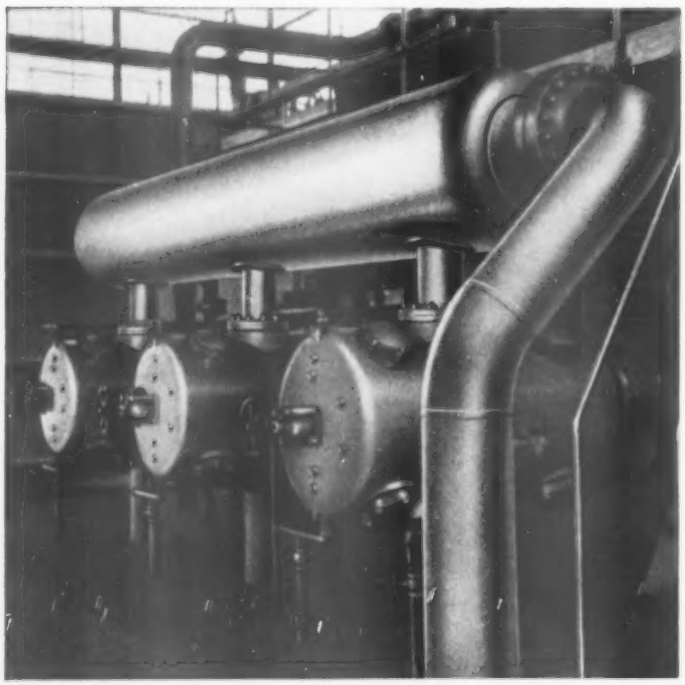
and gas measurement.

We invite you to write for your copy of an actual field report in survey and analysis of surge control with Burgess-Manning Pulsation Snubbers.

PACIFIC GAS & ELECTRIC COMPANY

Burgess-Manning Pulsation Snubbers installed on a gas compressor in the Topock Station of Pacific Gas & Electric Company



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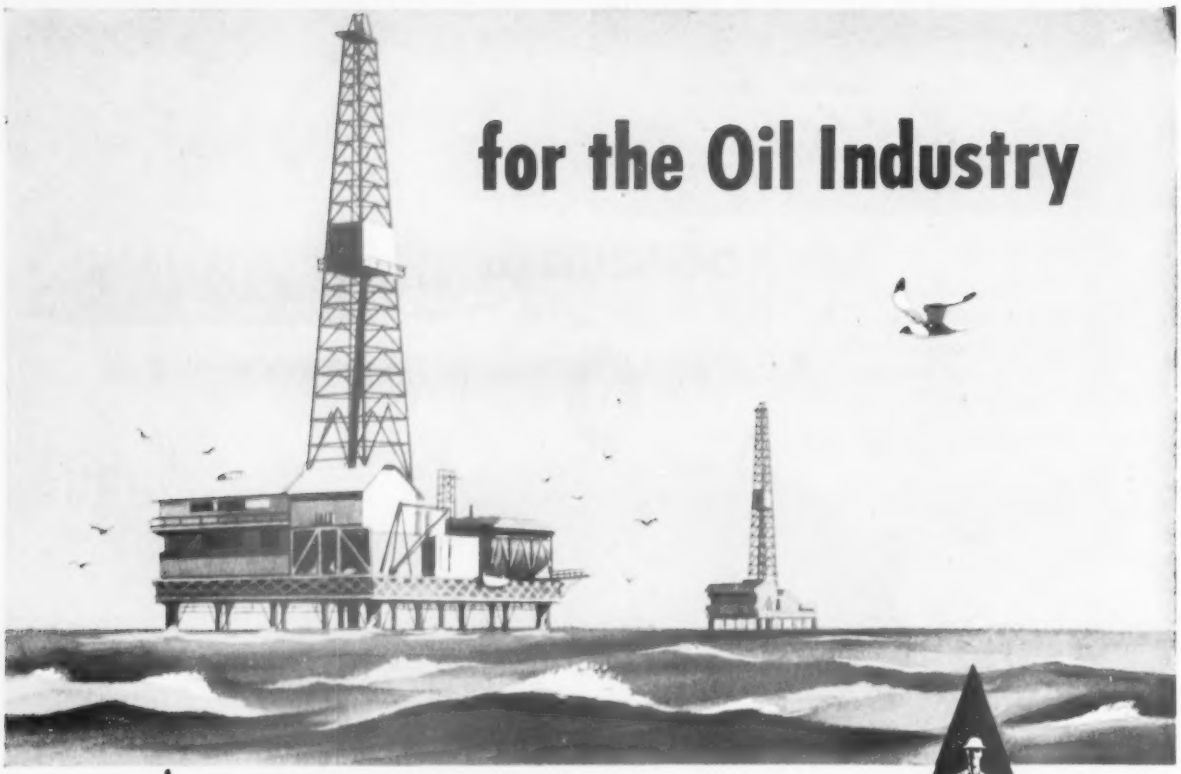

for the Oil Industry

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Complete facilities for a well-rounded service to the Oil Industry

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MAIN PLANT	"QUICK REPAIR PLANT"	SERVICE FOUNDRY
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Tightest gate valve . . .
. . . you ever used!

the original clip valve with the NEW **non-slip*** *handwheel**

King-clip®

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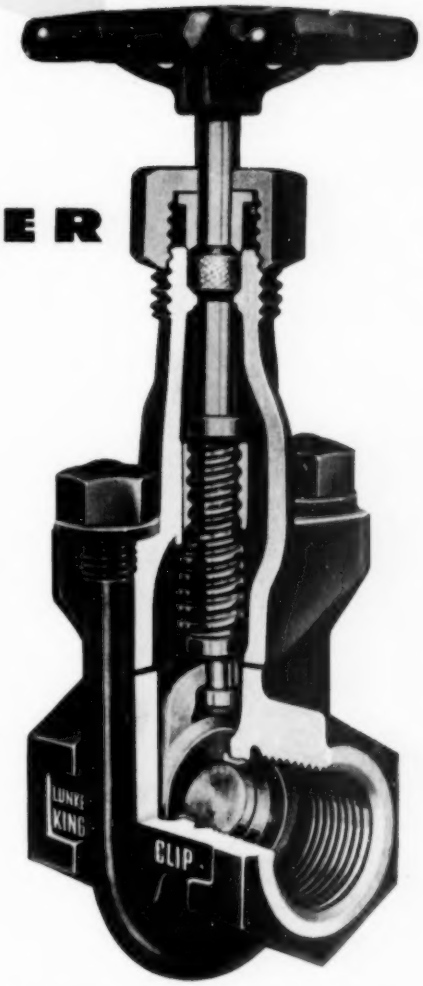

It closes tight . . . it stays tight . . . and here are four good reasons why:

The new Non-Slip Handwheel provides a firmer, more comfortable grip for closing — even when the operator's hands are wet or greasy.

The body provides unusual ruggedness — protects the valve against distortion from wrenching or pipe stresses . . . and the steel clip permits quick disassembly and reassembly.

Extra thread length prevents pipe ends from jamming against diaphragm or seat rings to force them out of line. Threads accommodate both A. P. I. and standard threaded pipe.

Stemalloy* stems, in the Iron Body Bronze Mounted patterns, have amazing resistance to thread wear. Millions are in use, and *not one* has ever been returned due to wear failure.

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Ask your Lunkenheimer Distributor about "King-clip" — the original Lunkenheimer clip valve with cast-in drain channels and a bonnet-thread bushing for perfect stem alignment. For full details, request Circular 561 from your distributor or The Lunkenheimer Company, Box 360F, Cincinnati 14, Ohio.

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THE ONE *Great* NAME IN VALVES

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In the field or on the highway... Eaton 2-Speeds cut hauling costs

By doubling the conventional number of gear ratios, Eaton 2-Speed Axles permit drivers to select the best ratio for every load and road condition. Whether hauling pipe over mud and ruts in the field or high-balling tankers over distribution routes, engines run in their most efficient speed range. This means less time in the shop, more time on the job, and thousands of additional miles of vehicle life. Eaton 2-Speeds last longer, too: positive lubrication at even lowest speeds is assured by Eaton's exclusive forced-flow oiling system, and planetary gearing better distributes gear-tooth loads. Ask your dealer to tell you how these and other exclusive Eaton features can help you save time and money in either production or distribution.

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AXLES

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EATON MANUFACTURING COMPANY
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Here indeed is a striking example of free enterprise at work in a highly competitive economy.

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Capable of drilling to depths beyond 20,000 ft., the modern integrated drilling barge, Blind Pass, represents a $1,500,000 investment in the very latest of design and construction.

Its power plant, the largest of any rig in the Gulf Coast area, boasts five 8-cylinder supercharged Superior Diesels (3350 total combined horsepower) equipped with hydraulic couplings for a fluid drive transmission.

To insure the overall working efficiency of this Diesel team, Ross Exchangers were furnished. Circulating water, lube oil and hydraulic fluid temperatures that *must* be maintained at correct level to safeguard engines and couplings — *are* maintained. *Overheating is most dependably prevented!*

Extremely rugged, pre-engineered and fully standardized, Ross Exchangers are used throughout the oil and gas industry: on diesels, compressors, turbines, hydraulic machinery, reduction gears, speed increasers.

For more information, request Bulletin 2.1K1.

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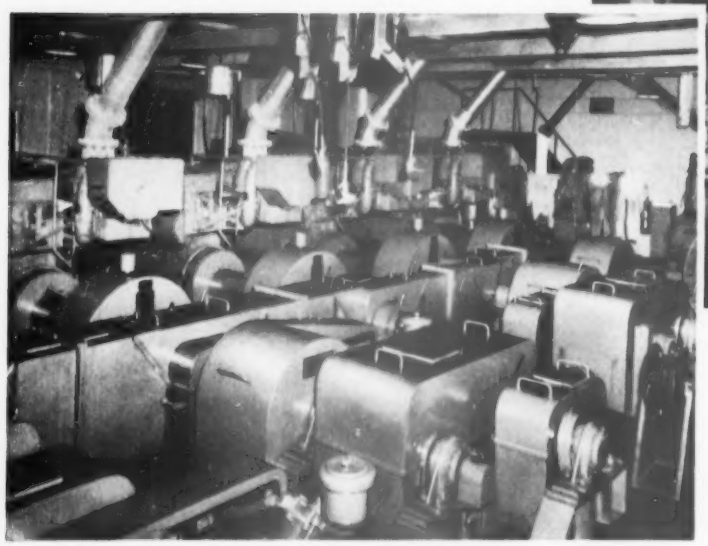

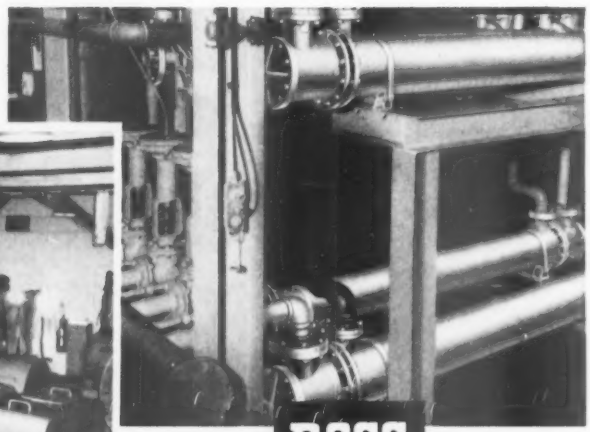

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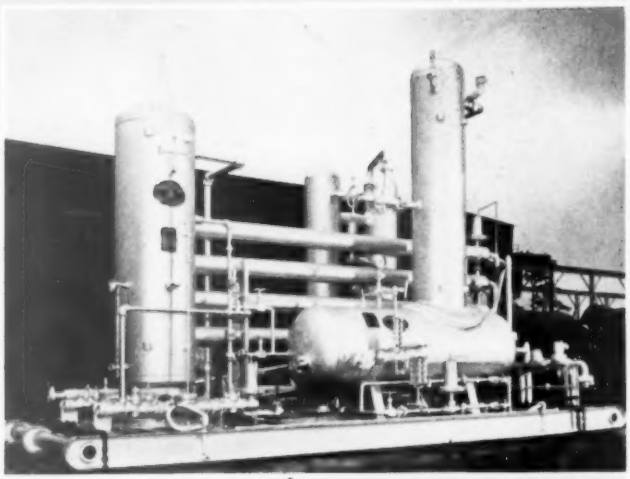

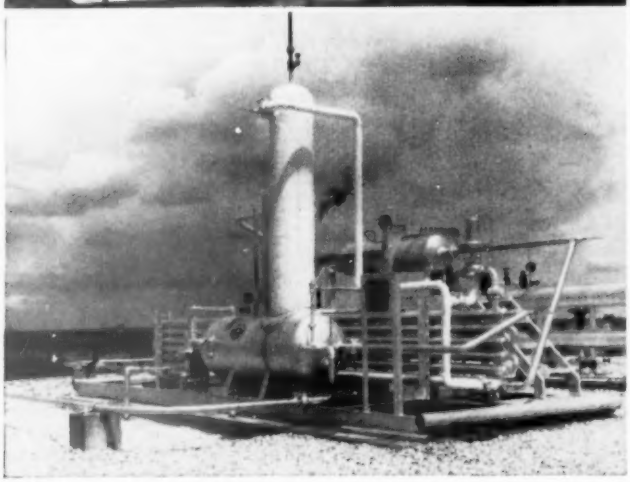

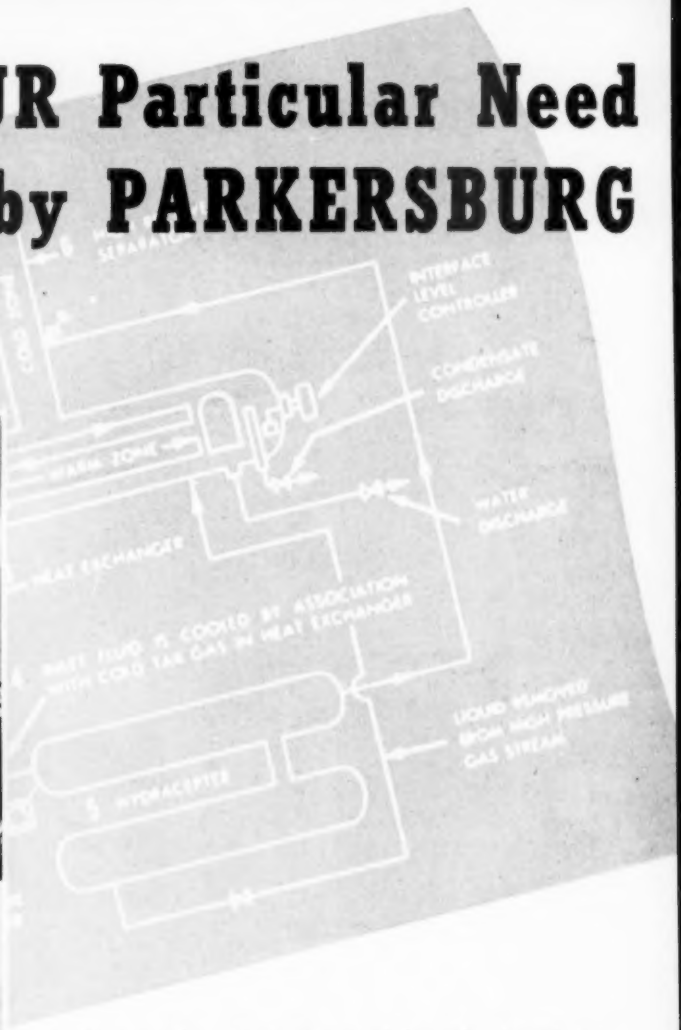

• Years of experience and hundreds of installations have proved to us that maximum benefits of cold separation are possible only when the installation is fitted to specific well conditions.

At Parkersburg our engineers, specialists in cold separation, correlate and analyze all the factors presented by your well. From this data they combine the standard elements of Hyreco cold separation units into the one assembly that delivers maximum efficiency on your well. Only Parkersburg's wide range of Hyrecos provides the extreme flexibility which makes this individual installation designing possible.

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HORIZONTAL AND VERTICAL SEPARATORS • HYRECO' • HYDRACEPTER • SCRUBBERS • TREATERS • HEATERS

Manufactured in Houston, Texas

H.P. pipe gaskets like these *made to your order* by gasket specialists...

...to save you both time and money

When you need metallic gaskets for high pressure piping, put the job up to Johns-Manville Goetze Gasket specialists. You benefit in many ways:

You get the exact gaskets you need for maximum efficiency under *your* operating conditions, tailor-made to fit *your* equipment. You get the savings in cost made possible by intensive specialization and modern production tooling. And you get the full benefit of over sixty years' experience in designing specialized metallic gaskets for industry's most complex sealing requirements.

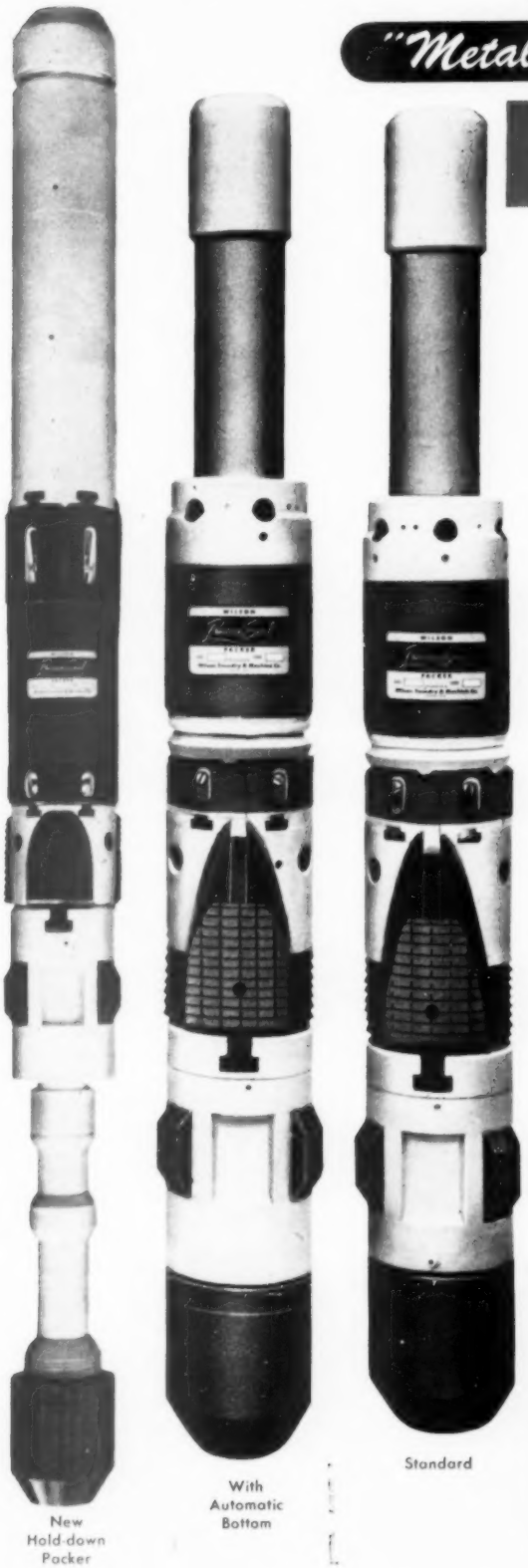
Typical styles of Johns-Manville Goetze Gaskets that have been made to order for high pressure piping service are shown above. The flare type gasket with bellows action and the solid flare type are particularly suited for pressures above 5000 psi; the profile and V-Tite gaskets are generally used for lower pressures. Each of these is fabricated to extremely close tolerances. Other styles can be made to any desired cross section to meet your individual requirements.

For more information about Johns-Manville Goetze Gaskets, write for your copy of Catalog PK-35A. Or send us your drawing or template for an immediate quotation. Address: Johns-Manville, Box 60, New York 16, N. Y.

Johns-Manville *Goetze* GASKETS

THERE'S A JOHNS-MANVILLE PACKING AND GASKET FOR EVERY SERVICE

THERE'S A WILSON "Metal Block" PACKER for Your Every Need



New Hold-down Packer

With Automatic Bottom

Standard

The "Metal Block" feature of Wilson type "MB" Packers makes them especially desirable on the real deep wells.

Where the hydrostatic head is greater than the bottom hole pressure—use the standard type "Metal Block" Packer.

Where the pressure is greater below the packer—in dual completions; fracturing or acidizing jobs—use the new Wilson Hold-down Packer.

Where you want to release packer to go lower, without having to "re-J," use the standard "Metal Block" Packer with automatic Bottom.

For all around performance use a Wilson "Metal Block" Packer.

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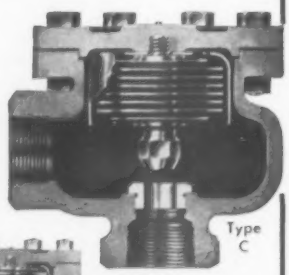
LEADING PROCESSOR

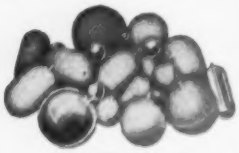
SHORTENS OPERATION

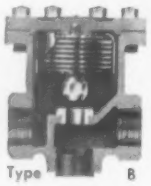
from 65 to 45 Min.

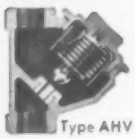
with Nicholson Steam Traps

Records of a recent installation of Nicholson steam traps, by a large processor, show they cut heating cycles 30%; e.g., one operation was shortened from 65 to 45 min. Nicholson units keep equipment full of live steam because: 1) they operate on lowest temperature differential; 2) have 2 to 6 times average drainage capacity, low for steam waste; and maximum air-venting capacity. Widely specified for preventing damage to thin gauges; eliminate cold blow in unit heaters.









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HIGH-PRESSURE FLOATS—Stainless, monel, steel or plated steel. Welded. In all sizes and shapes; for operating mechanisms and as tanks or vessels. **BULLETIN 753.**

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W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

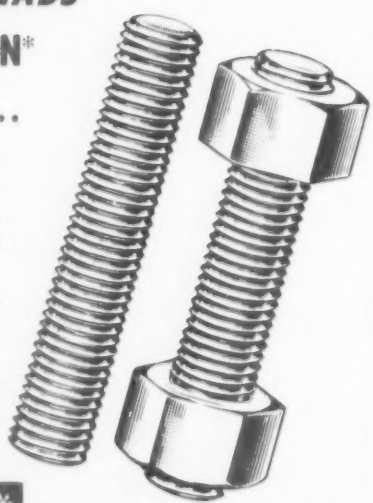
ALLOY STEEL BOLT STUDS

With *GROUND THREADS*

Produced By KILBOURN* At No Extra Cost...

- Made from heat-treated bars—(A.S.T.M. A193 Grade B-7).
- Threads *centerless-ground* to provide smooth finish unobtainable with most other production methods.
- Finish of KILBOURN ground threads greatly reduces seizing during assembly or disassembly.
- Widely used by oil refineries, chemical plants, power plants, pipe-line installations.

WRITE TODAY for SAMPLE Bolt Stud.



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5100 N. 35th St. • Milwaukee 10, Wis.

STUDS • THREADED BARS • STILL SCREWS • STAINLESS STUDS AND NUTS

They Say—

PAD Must Be Kept Intact

"There are several other reasons for maintaining PAD (Petroleum Administration for Defense) as an agency in addition to the crucial function of overall defense planning for the oil and gas industries. Chief among these has been the continuing shortage of high-octane aviation gasoline, principally for the military. There is a need for a government agency, staffed with expert technicians who can advise the armed services on methods of meeting their needs for this gasoline in the critical years ahead.

"The construction of some vitally needed alkylate plant might be held up because the refiner building it can't obtain essential equipment when it is needed. There should be a government agency to see that the required item is supplied in such cases of acute spot need in important military projects.

"It will still be necessary . . . to have an agency that can receive and process applications for fast tax write-offs on the cost of facilities the industry wouldn't be building except for the necessity of defense-mobilization.

"To sum it up, PAD's principal work will be related, as in the past, to defense planning."

R. E. Nelson, Jr., pipe-line manager for Standard Oil Co. (Ind.), addressing the North Dakota Oil and Gas Association, Bismarck.

Gas Industry Now Has Two Friends

"Two recent changes in Washington government activities are of major significance to the natural-gas industry. One was the advancement of Sen. John W. Bricker to the chairmanship of the Senate commerce committee succeeding (the late) Sen. Charles W. Tobey. . . The other was President Eisenhower's appointment of S. L. Digby of Louisiana to a post on the Federal Power Commission.

"These moves placed in strategic positions two friends of free enterprise and opponents of federal control of the oil and gas industry.

"Senator Tobey was a militant advocate of government regulation. As committee chairman he opposed Rigby's appointment, and pigeon-holed a bill sought by the gas industry and sponsored by Senator Bricker, removing some FPC controls over natural-gas distribution within a state.

"Congress passed a bill exempting independent gas producers and gath-

most widely imitated Rotary Hose in the oil fields

Thermoid

POWERFLEX

Rotary Hose & Discharge Units

premium quality at regular price!

- Oil and abrasion resistant synthetic tube.
- Impregnated multi-ply woven fabric body.
- High tensile steel cable reinforcement.
- Patented full-flow couplings securely anchored to each individual cable—positively cannot blow off.
- Tough, extra-heavy, weather and abrasion resistant cover.
- Coupling guaranteed leak-proof for hose life.

Each length pre-tested to 5000 psi before shipment.

Exceeds all A.P.I. requirements for Grade C Hose.

Available in all standard sizes and lengths. Get Powerflex from your supply house or the nearest Thermoid warehouse.

Thermoid Industrial Rubber Products — Quality Value Service

Mid-continent Office and Warehouse: Houston, Texas
California Office and Warehouse: Los Angeles, California

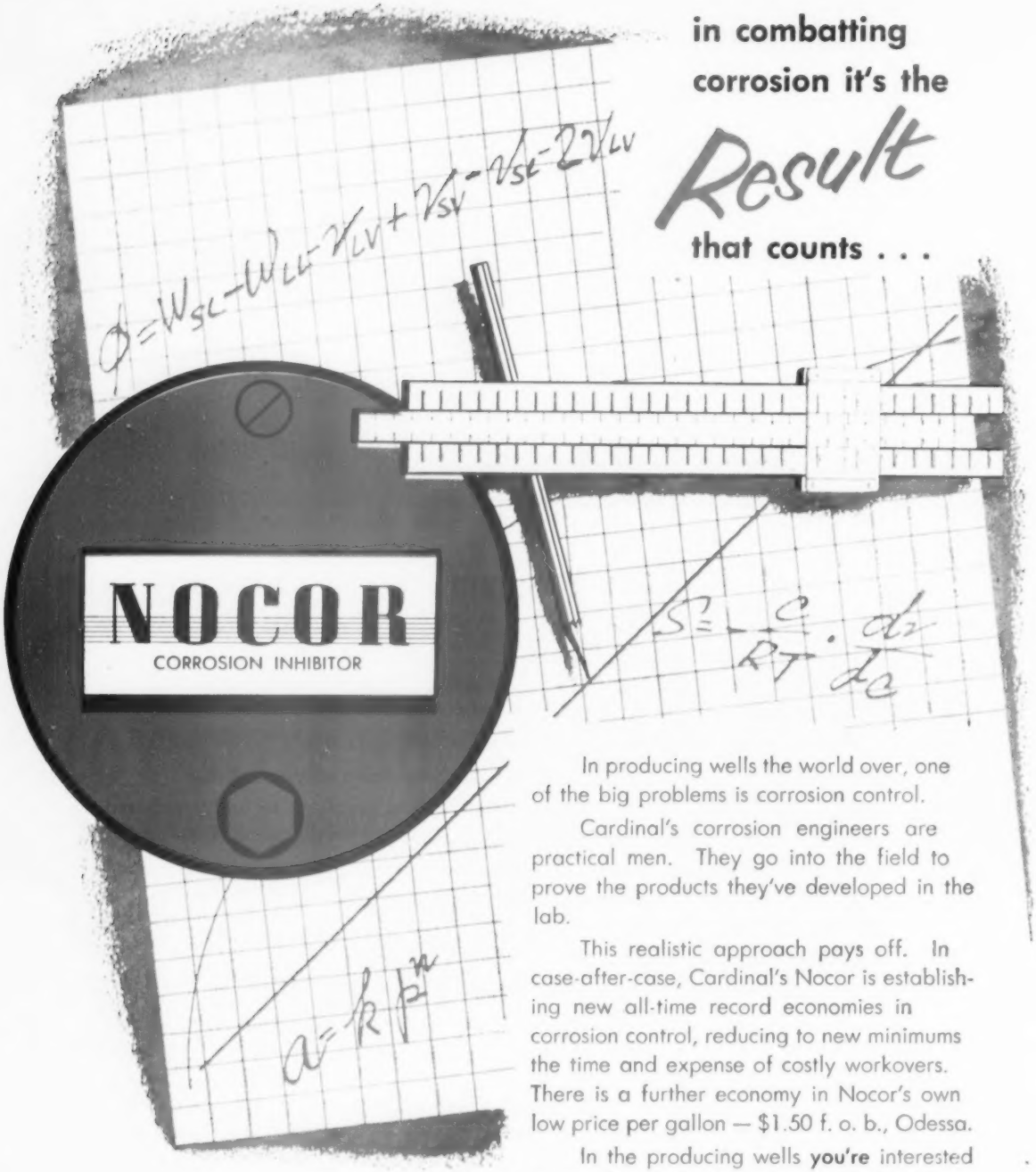
SEE OUR CATALOG IN THE COMPOSITE CATALOG

Powerflex Rotary Hose • Trioflex Slim-Hole Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discharge Units • F.H.P. and Multiple V-Belts • Oil Country Flat Belting

Thermoid

Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All Types of Hose • Molded Specialties • Brake Blocks

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah



in combatting corrosion it's the

Result

that counts . . .

In producing wells the world over, one of the big problems is corrosion control.

Cardinal's corrosion engineers are practical men. They go into the field to prove the products they've developed in the lab.

This realistic approach pays off. In case-after-case, Cardinal's Nocor is establishing new all-time record economies in corrosion control, reducing to new minimums the time and expense of costly workovers. There is a further economy in Nocor's own low price per gallon — $1.50 f. o. b., Odessa.

In the producing wells **you're** interested in, get the result that counts. Get Nocor "102".

WRITE FOR ILLUSTRATED BULLETIN

CARDINAL CHEMICAL · INC.

HOME OFFICE ● ODESSA, TEXAS ● BOX 2049

erers from the jurisdiction of the FPC, but President Truman vetoed it. In the Phillips Petroleum Co. case, the U. S. Circuit Court of Appeals held that FPC is authorized to regulate field prices. The case has now gone to the Supreme Court for decision.

"If the high tribunal sustains the appellate court and orders the commission to regulate gas sales by independents, then it will be very important to the gas industry to have a majority for fair prices on the commission."

Editorial in The Houston Post.

U. S. Fears Iran's Weakness

"Iran is a weak, divided, poverty-stricken country which possesses an immense latent wealth in oil and a crucial strategic position. This is very different from neighboring Turkey, a strong, united, determined, and advanced nation, which can afford to deal with the Russians because she has nothing to fear—and therefore the West has nothing to fear. Thanks largely to Dr. Mossadegh, there is much to fear in Iran."

From an editorial in the New York Times.

G.O.P. Isn't Industry's Pal, Either

"Regardless of the party in power in Washington, the oil industry seems destined to remain the pet target for political persecution and exploitation.

"The industry was called upon to fuel World War II and at its conclusion, received an elaborate accolade from Washington for a vital and magnificent contribution.

"And now in 1953, here we go again. The national defense picture demands that the oil industry be prepared to fuel another war—so said official Washington 3 years ago—only this time the requirements will be far greater than for World War II.

"Maintaining their record for public and patriotic service, the oil men rolled up their sleeves and developed a reserve producing capacity of 1,000,000 bbl. a day. This was accomplished in the face of substantial increases in costs of labor and materials and in competition with excessive imports of foreign oil, a laudable and praiseworthy, but nonetheless costly, achievement.

"Now let us take a look at the recognition the industry received from Washington for such a 'laudable and praiseworthy' achievement. An inadequate but long overdue increase in the posted price for crude of less than 10 per cent and a 3 to 4 per cent increase in gasoline prices brought forth a vicious castigations of the oil business by Chairman Wolverton (Republican) of the House commerce committee, with

DRESSERTAPE ... the name that means

QUALITY PROTECTION

... against corrosion

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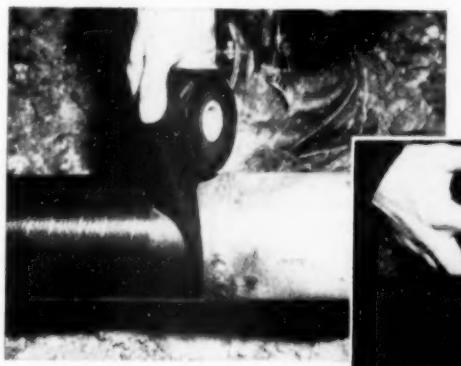

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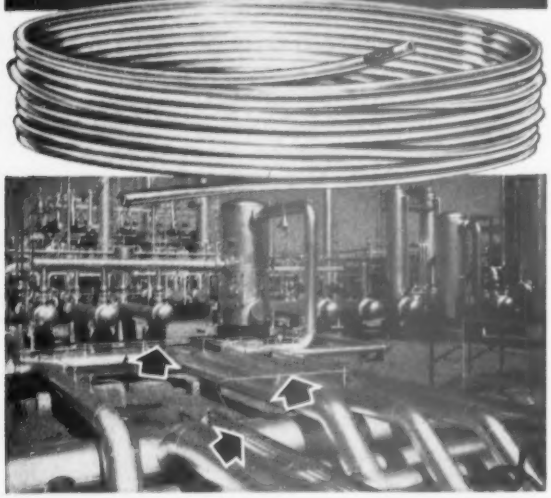

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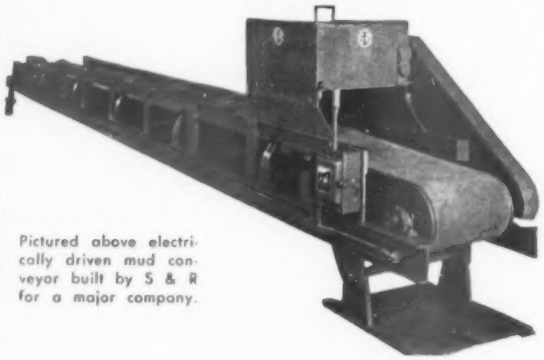

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announcement of a sweeping investigation of the entire industry by his committee."

E. I. Thompson, executive vice president of the Texas Independent Producer & Royalty Owners Association, in the association's publication 'Tipro Topics,' Austin.

CALENDAR

AUGUST

Aug. 31-Sept. 1 Interstate Oil Compact Commission, Northern Hotel, Billings, Mont.

SEPTEMBER

1- 4 American Institute of Electrical Engineers, Pacific general meeting, Hotel Vancouver, Vancouver, B. C.

6-11 American Chemical Society, national meeting, Conrad Hilton Hotel, Chicago.

9-11 Pacific Coast Gas Association, San Francisco.

11-12 Association of Desk and Derrick Clubs of North America, annual meeting, Cosmopolitan Hotel, Denver.

13-16 American Institute of Chemical Engineers, Fairmont and Mark Hopkins hotels, San Francisco.

15-16 American Petroleum Institute, executive committee, Greenbrier Hotel, White Sulphur Springs, W. Va.

16-18 National Petroleum Association, annual meeting, Hotel Traymore, Atlantic City, N. J.

21-22 Natural Gasoline Association of America, fractional analysis seminar, Texas Hotel, Fort Worth.

21-25 Instrument Society of America, national instrument conference and exhibit, Sherman and Morrison hotels, Chicago.

22-25 Corrosion short course, Texas A. & M. College, College Station, Tex.

24-25 Western Petroleum Refiners Association, regional meeting, Henning Hotel, Casper, Wyo.

27 Institute of Gas Technology, annual meeting, Chase Hotel, St. Louis.

27-30 American Society of Mechanical Engineers, annual conference, petroleum division, Rice Hotel, Houston.

Sept. 27-Oct. 2 American Society for Testing Materials, Committee D-2 on petroleum products and lubricants, Shoreham Hotel, Washington, D. C.

28-29 Independent Natural Gas Association of America, Shamrock Hotel, Houston.

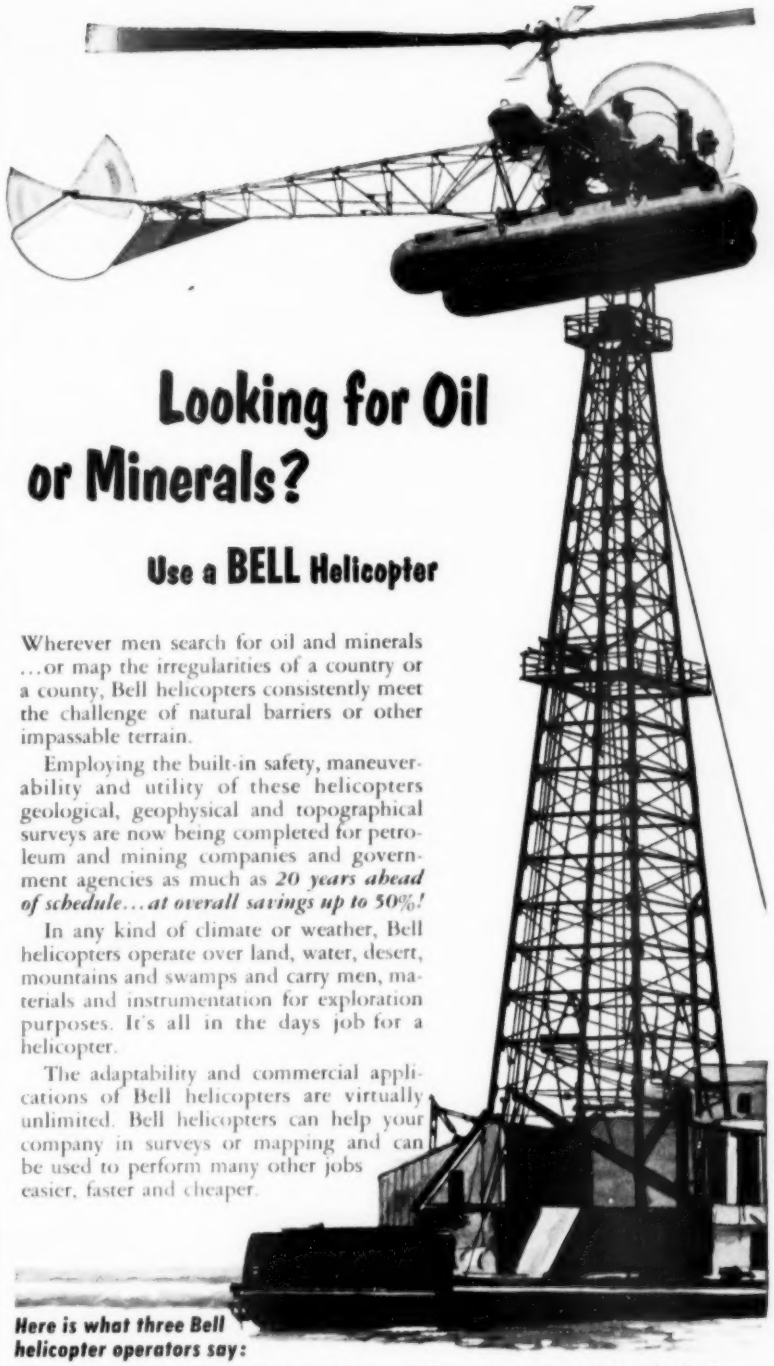
Sept. 30-Oct. 2. American Association of Petroleum Geologists, Mid-Continent regional meeting, Masonic Building, Wichita.

Sept. 30-Oct. 2 National Association of Corrosion Engineers, Permian Basin section, biannual field tour, Lincoln Hotel, Odessa, Tex.

OCTOBER

1- 2 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

4- 6 American Association of Oilwell Drilling Contractors, thirteenth annual meeting, Cosmopolitan Hotel, Denver.



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"The survey accomplished by Bell helicopters in one summer would take 20 years by any other method."—JAMES S. RICKLEFS, Rick Helicopters, Inc., Los Angeles, California.

"Allied's Bell helicopters have done mapping and survey work intheRockies and Alaska at savings of 50% and more over other methods."—ROY B. DAVID, Allied Helicopter Service, Tulsa, Oklahoma.

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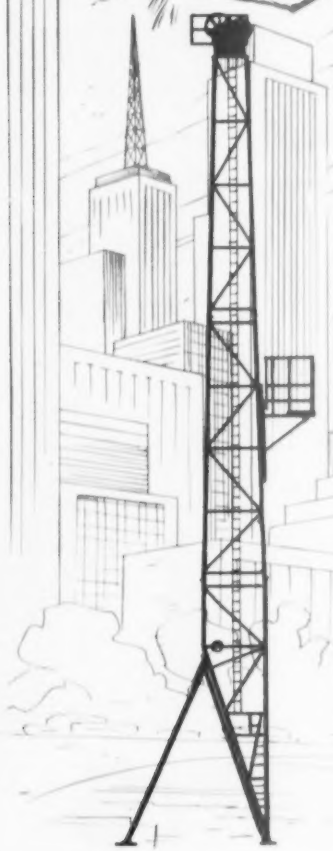

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5- 7 Petroleum Electric Power Association, silver anniversary meeting, Muehlbach Hotel, Kansas City.

6- 7 Texas Mid-Continent Oil and Gas Association Rice Hotel, Houston.

7- 9 National Association of Corrosion Engineers, south central region, Mayo Hotel, Tulsa.

8- 9 California Natural Gasoline Association, annual fall meeting, Ambassador Hotel, Los Angeles.

11-17 Oil Progress Week.

12-16 Short course on cathodic protection, University of Illinois, Urbana.

16-18 New Mexico Geological Society, fourth annual field conference, El Paso, Tex.

19-21 American Institute of Mining and Metallurgical Engineers, petroleum branch, fall meeting, Dallas.

19-20 Independent Petroleum Association of America, annual meeting, Texas Hotel, Fort Worth.

21-23 Gulf Coast Association of Geological Societies, third annual convention, Captain Shrene Hotel, Shreveport.

22 American Institute of Chemical Engineers, New York section, symposium, Hotel New Yorker, New York.

22-23 Western Petroleum Refiners Association, regional meeting, Garrett Hotel, El Dorado, Ark.

23 Natural Gasoline Association of America, regional meeting, Blackstone Hotel, Tyler, Tex.

26-29 American Gas Association, annual conference, Kiel Auditorium, St. Louis.

27 Association of Consulting Chemists and Chemical Engineers, Inc., annual meeting, Hotel Belmont Plaza, New York City.

28-30 Seventeenth Technical Conference on Petroleum Production, Mineral Industries Building, Pennsylvania State College, State College, Pa.

29-31 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

NOVEMBER

3- 4 Society of Automotive Engineers, national diesel-engine meeting, Conrad Hilton Hotel, Chicago.

5- 6 Society of Automotive Engineers, national fuels and lubricants meeting, Conrad Hilton Hotel, Chicago.

5- 6 American Association of Petroleum Geologists, Pacific section annual meeting, Hotel Biltmore, Los Angeles.

9-11 Geological Society of America, annual meeting, Royal York Hotel, Toronto, Ont.

9-12 American Petroleum Institute, annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

12-13 Society of Exploration Geophysicists, midwestern meeting, Adolphus Hotel, Dallas.

19-20 National Association of Corrosion Engineers, western region, fall conference, Biltmore Hotel, Los Angeles.

19-20 Annual Instrument Short Course, Los Angeles Harbor Junior College, applied technology division, Wilmington, Calif.

20 Natural Gasoline Association of America, regional meeting, Herring Hotel, Amarillo, Tex.

Nov. 29-
Dec. 2 American Society of Mechanical Engineers, Statler Hotel, New York City.

DECEMBER

1- 4 Corrosion conference, University of Oklahoma, Norman.

13-16 American Institute of Chemical Engineers, annual meeting, Hotel Jefferson, St. Louis.

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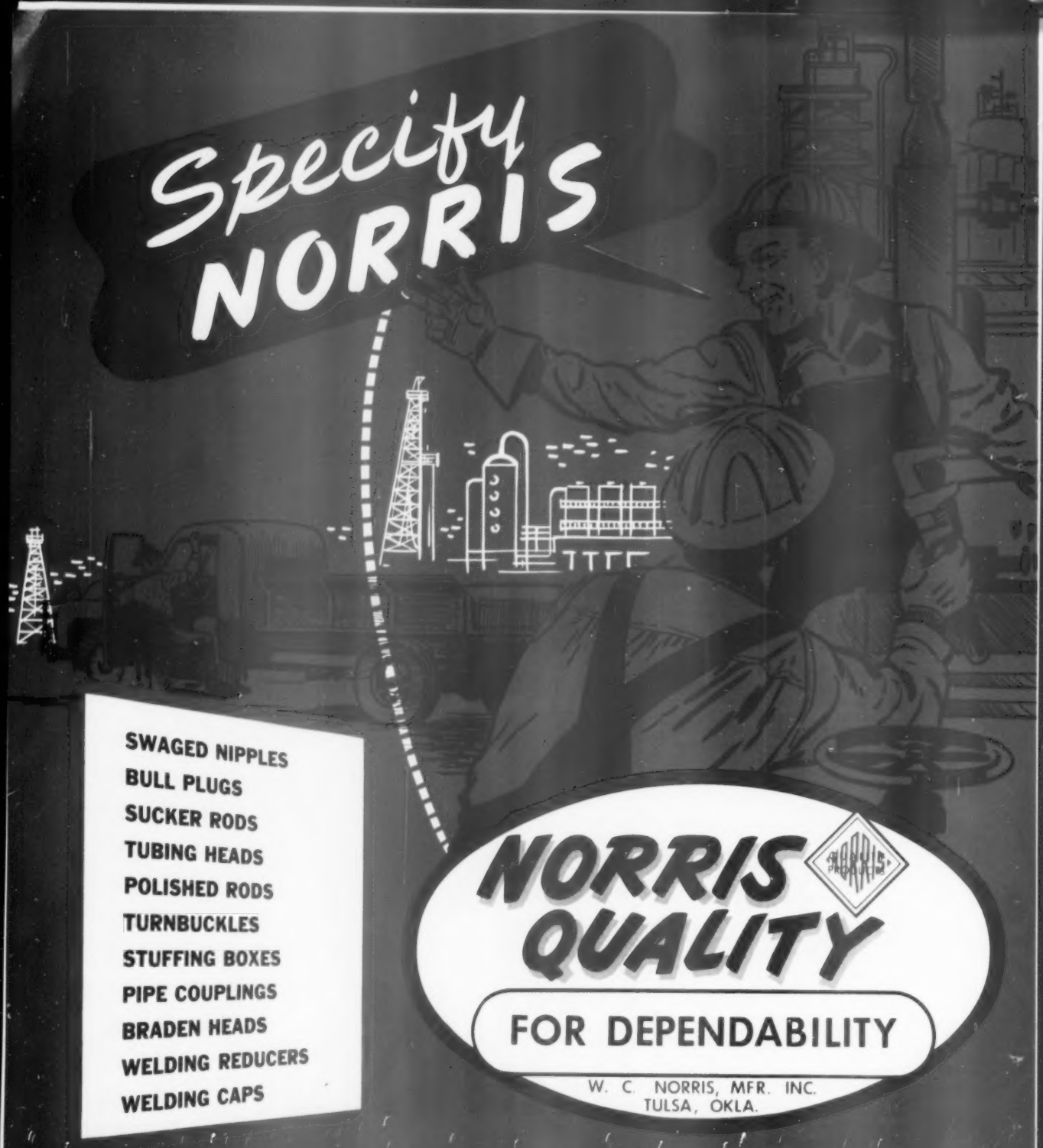

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JOURNAL
TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa, Oklahoma. Phone 3-6291. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

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JOURNALLY Speaking

Doubled Digest

INTERESTED in new equipment that might be used on your job? Then you doubtless are a regular reader of the Big Yellow Book's Equipment Digest. Only sometimes when you've looked for it you couldn't find it. That's because we have been running it only alternate weeks.

This didn't make sense, because American inventive genius is at work every week. We now have corrected this deficiency. From now on this feature will appear in every issue (except sometimes in those big, fat, special issues, and in them you get enough other material to make up for it).

If you think this Equipment Digest is just a come-on game to induce manufacturers to advertise, you're wrong (though, of course, if they insist on buying space to tell more about their products we usually manage to accommodate them). This is a valuable editorial feature. Many of our readers tell us so, and all our readership surveys show that it is very popular.

Possibly some readers peruse this department simply because of a fascination for gadgets, but most of them are seriously looking for new instruments and machinery which will get a job done better, quicker, or cheaper. In order to give everyone an even break, Dan Miller, who edits this department, really does a digest job on some of the material he receives, and trims it down to a couple of succinct paragraphs. But if you want more information all you have to do is check off a number on the yellow self-addressed, prepaid postcard and drop it in the mail. That's what we call service.

Socia-bull

NOW a new association is being formed in the oil industry—the P.I.R.A.

Do you ever find yourself in a strange oil town with time on your hands and wish that you knew some congenial oil men to talk shop with or to join you for a steak, a round of golf, or a hand of gin rummy? If you are a member of this new Petroleum Industry Recreation Association all you have to do is look up the local secretary in the phone book and be referred to some local members.

At least that's the promise of the originator and promoter of the idea, Henry Hough, editor of our esteemed contemporary, the Rocky Mountain Oil Reporter. Members will be known as Socia-bulls; wives (and/or secretaries?) can become associate members known as Socia-belles. It sounds like a sort of poor man's petroleum club, but since it springs from Denver we wonder if it is a tourist-promotion scheme backed by the resort owners of cool, colorful, customer-craving Colorado.

Alaskan Dilemma

A READER in Alaska is jealous of the good mail service enjoyed by subscribers in North Africa, as related in a recent note on this page. He writes from Anchorage that his copy of the Big Yellow Book customarily arrives 5 or 6 weeks after date of publication, whereas the man in Algeria gets his issues only about 3 weeks late.

This gripes him because Alaskans don't consider themselves "foreign," and they think they should get better mail service than Africans. He wants to know what we would suggest. Since we have no control over mailboat schedules, we can think of only two possibilities:

1. Alaska can redouble its efforts to get admitted as a state and then Alaskans will have equal standing with other first-class citizens in complaining and voting against any and all government activities that don't happen to please them. However, this is no guarantee that it will improve the mail service; ask any resident of the States.

2. Secede from the United States and set up shop as a foreign country. Then Alaska could apply for Point-Four Aid, Mutual Security Assistance, and other forms of international largess. This would undoubtedly double the shipping service.

—*Henry D. Ralph.*

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...to provide ample all-around cementing space for all casing programs, regardless of varying hole sizes or conditions.

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WHY REACH IS NEEDED In oversize sections of open hole, centralizers with insufficient reach frequently fail to contact the wall of the hole and thus perform no work. As a result, adjacent centralizers above and below can be so overburdened that casing-to-wall contact is apt to occur. The end result is likely to be a poor cement job at any such point of contact.
The increased *reach* of Baker HINGE-LOK Casing Centralizers ensures that each centralizer will contact the wall of the hole within its range and will contribute its share toward an effective centering job.

MAXIMUM STRENGTH The engineered bow shape of the centralizer springs provides *greater landed centering force* than can be obtained from any other available hinge-type centralizer covering the same range of open hole sizes.

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SUPER-RANGE
Product No. 9114
For GREATER-THAN-NORMAL CLEARANCE or where extensive hole irregularities are anticipated in otherwise normal clearance.

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The Rockies have broken oil's vicious circle

FOR a generation or more it has been well known that the Rocky Mountain region held promise of being one of the great oil-producing areas of the United States. But only during the last few years has the region seen exploration activity on a scale commensurate with its potentialities.

Why the delay? Chiefly because of lack of markets. Many of the sedimentary basins lying between mountain ranges are geologists' dreams in that their structures and formations can be determined at the surface. But what would be the good of a producing well there without a market for the oil?

Except for one relatively small crude line to the east, the market for Rocky Mountain oil has been entirely local or within the region itself, and oil development was limited by local consuming ability.

A SIZABLE "outside" market did not develop until the war, when crude was needed regardless of type, location, or transportation cost. This stimulated drilling activity which has sustained its momentum until today the region's producing capacity is supporting a new, large crude line to the east and other lines, completed or under construction, are opening new marketing territory to the northwest.

If these new pipe lines had been built a dozen years ago, production in the Rocky Mountain region would have expanded rapidly at that time. Why weren't they built? Because there was not enough production to support them.

This basic dilemma of the oil industry looks like a vicious circle, like the argument over whether the hen or the egg came first. It is always broken because some interests, either producers or pipe liners, take a pioneering chance and get out ahead of the parade. This usually spurs other segments of the industry to catch up or even spurt ahead

THUS the oil industry advances through the interdependence and integration of its several branches, but the progress is normally marked by uneven jerks and lags. Seldom is there an exact balance in the growth of production, transportation, refining, and markets.

The Williston basin currently is a prime example of this, with production shut in well below capacity. Producers first had to demonstrate that they had sufficient reserves to justify pipe lines and refineries, and now they must mark time until these are constructed.

This is always the penalty of pioneering—to wait until the rest of the world catches up. But pioneering is a way of life in the Rockies and in the oil industry, and the vast Rocky Mountain region at last is on the point of cashing in on its many years of oil pioneering.

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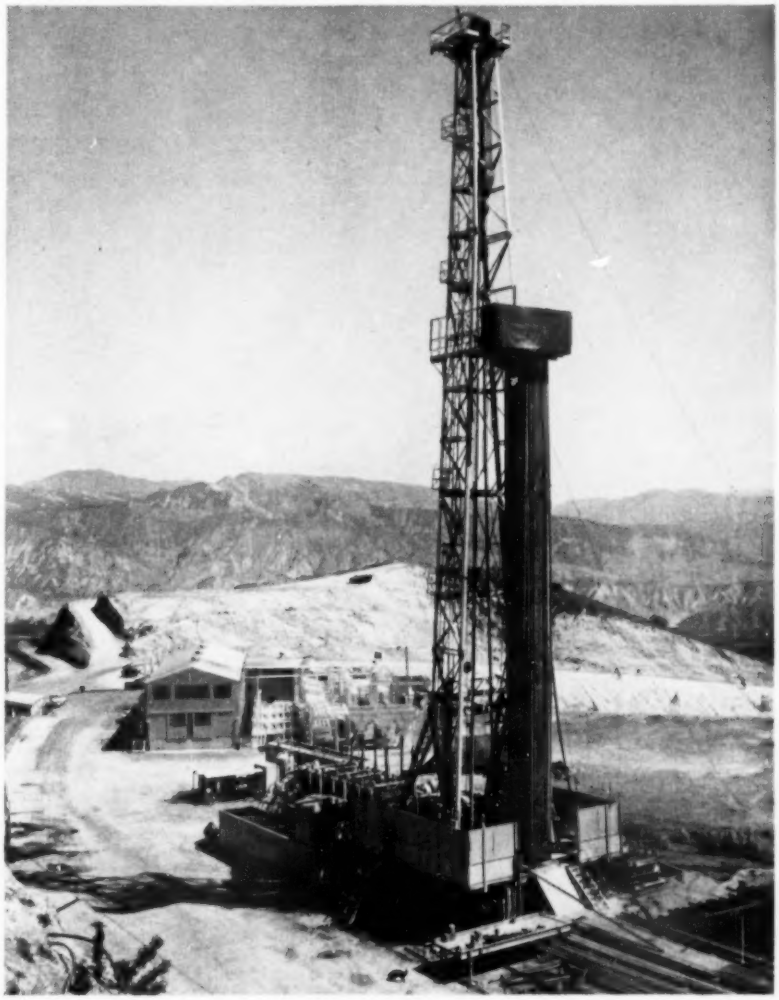
THIS WEEK



HIGH ON A HILL overlooking Santa Clara Valley, the locale of one of the most concentrated exploration programs in California, Union Oil Co. 92 Torrey last week was drilling below 14,100 ft. in Torrey Canyon field. The deep-zone test has already indicated it will make a deeper-pool discovery in a 13,000-ft. Eocene pay in addition to being productive in the field's regular 9,500-ft. Sespe pay. The well may go to 15,000 ft. in an effort to locate high-gravity production. Behind the rig is a new compressor station to handle the 1,500 M.c.f. of gas from Torrey Canyon's seven producers.

PRODUCTION. — Railroad Commission to receive last briefs this week in dispute over field rules for giant water flood in Kelly-Snyder field, Scurry County, West Texas. . . . SACROC officials expect oral argument on two conflicting injection plans to be held in mid-September, hope for commission's final decision by October 1. . . . ¶Unitization and repressuring plan for Canada's biggest pool, Redwater field northeast of Edmonton, awaiting approval. . . . Twenty-five operators to meet this week in effort to reach complete agreement. . . . ¶Railroad Commission order requires that wells be properly cased to protect fresh water sands before such wells are granted allowables. . . .

COURTS.—The U. S. Supreme Court is pondering whether or not "arm's length" sales of natural gas are within the jurisdiction of the Federal Power Commission. . . . The issue was laid before the court August 20 when Phillips Petroleum Co. appealed a lower-court decision reversing the FPC stand that it had no jurisdiction over Phillips operations. . . . States of Texas, Oklahoma, and New Mexico join Phillips in the appeal contending FPC control will jeopardize expansion of natural-gas supplies. . . . ¶California resorts to the courts for the second time in 2 months to conserve underground oil reserves by halting excessive use of gas in the Aliso Canyon field. . . .

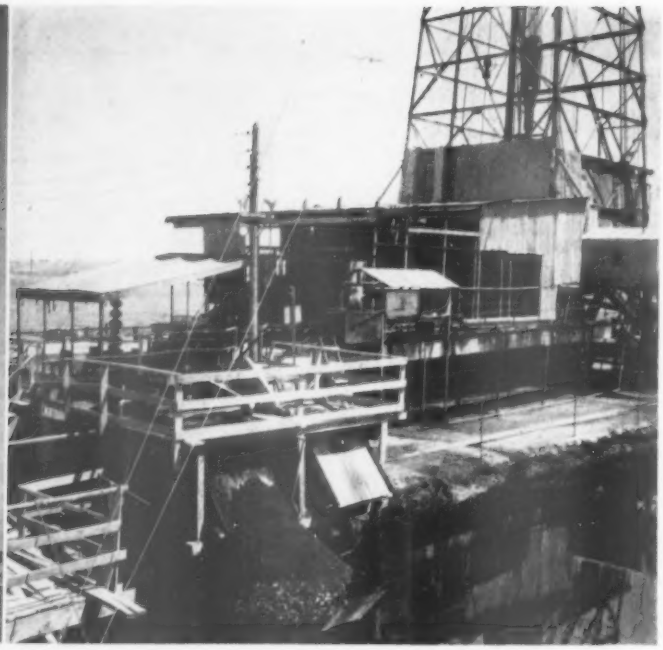
PIPE LINES.—U. S. Engineers advertise for bids on the 615-mile military products line from Haines to Fairbanks, Alaska. . . . Bid opening is scheduled for October 14, with September 1955 as the completion date for the line. . . . ¶Texas remains cool to an offer to purchase its royalty oil at a bonus price to supply a proposed pipe line to the West Coast. . . . The 15,000 bbl. daily sought by West Coast Pipe Line Co. represents one-third of the volume needed to make the line feasible. . . . ¶Gabriel Oil Co. starts work on first line to import crude from Mexico to U. S.

INTERNATIONAL.—The new Iranian Government of the Shah hasn't committed itself on the oil dispute, but indications are that a settlement with Anglo-Iranian Oil Co., Ltd., will be made within a year. . . . ¶First export of crude from the Wafra field of the Neutral Zone in the Middle East is expected by the end of the year. . . . Construction is under way on a 35-mile pipe line from the field to an offshire loading point at the northwest corner of the zone.

ACTIVITY.—Production of crude and lease condensate averaged 6,575,850 bbl. daily for week ended August 22, up 21,500 bbl. daily. . . . ¶Operators completed 1,020 wells for the week compared with 1,011 for previous week and 934 for same week last year. . . . ¶Wildcat completions increased 22 to 255. . . . ¶Rotary rigs operating in the United States decreased 22 rigs for week ended August 24 to 2,598 with the biggest decrease noted in the Rocky Mountains. . . .

TRENDS.—Cumulative U. S. crude-oil and lease condensate production for the period January 1-August 22 stands at 1,509,334,300 bbl. compared to 1,438,150,250 bbl. this date last year. . . . Nebraska crude-oil production increased 700 bbl. daily for the week ended August 22, setting a new record high for that state. . . . Daily average production in Colorado has been running over 100,000 bbl. since June 13 with the record high of 110,200 bbl. set during the week of August 1. . . . New Mexico crude-oil production hits year's high of 200,050 bbl. daily during week of August 8.

RECORD-BREAKING RIG has 14-ft. substructure, 164-ft. derrick. Portion of 5,143 ft. of cores is in foreground.



VIEW OF RIG from mud side. Mud from return line (far right) empties into mud ditch, which in turn empties into shale shakers at left.

Drilling-Depth Record Stretched

Ohio's California wildcat coring ahead more than a week after breaking former record in its search for Eocene oil

BAKERSFIELD.—Only time will tell what depth record will be left by Ohio Oil Co. for the oil industry to shoot at.

Nearing 20,600 ft. and with more than 9,600 ft. of open hole above it, the core head was grinding on downward at the end of the week in Ohio's 72-4 K.C.L.-A., the Paloma field wildcat originally projected to the Point of Rocks sand in the Eocene.

The world's record-setter, which passed Superior Oil Co.'s previous mark of 20,521 ft. on August 20, still was short of its goal—a thorough test of oil possibilities of Eocene rocks—but was coring ahead toward that objective.

Although casing was set only through Paloma field's regular Sespe sand pay in the upper Miocene at 10,947 ft., the open hole below that point was considered in good condition.

A mud weight of about 115 lb. per cubic foot, or about 15.4 lb. per gallon, has been maintained below 13,818 ft., where a heavy flow of salt water was encountered. Except for this instance, little trouble has been encountered from contaminants or loss of mud.

Ohio has been using oil-base mud since it reached a depth of 10,955 ft.

Near end of second year . . . As coring continued it appeared possible the crews might still be drilling on the second anniversary of the drilling operation, which will arrive October 23. The rig was in its 668th day of drilling when the hole passed 20,521 ft., the 4-year-old record established by Superior 1 Unit in Sublette County, Wyoming.

Diamond-core heads have been used extensively below 13,500 ft., averaging about 55 to 58 ft. before replacement. The diamond tools have been left in the hole as long as 7 days, however. More than 130 cores have been cut, aggregating more than 5,200 ft. of hole. About 100 ft. of this was done in upper

CHECK ON MUD in suction tank is made by Clarence Craig, derrickman. Mud system of well holds about 1,750 bbl. of oil-base mud at depths below 21,522 ft.

CLOSE LOOK at core is taken by R. W. Shoemaker, Ohio Oil district geologist, and Tom Wilson, geologist, at Bakersfield, Calif., district of the company.

DIAMOND BIT pulled at 20,246 ft. is examined by Bill McLaughlin, rotary helper. Bit had been on bottom 107½ hours, and had made 113 ft. of hole.

RING GAGE is used by Wyatt Harris, driller, to check diamond bit. Penetration rates below 13,000 ft. were 1 ft. per hour in shale, 2-3 ft. in sandstone.

beds with conventional core heads, but nearly 5,000 ft. has been cored with diamond heads below 14,000 ft. Penetration rates below 13,000 ft. have been about 1 ft. per hour in shale and 2 to 3 ft. per hour in sandstone.

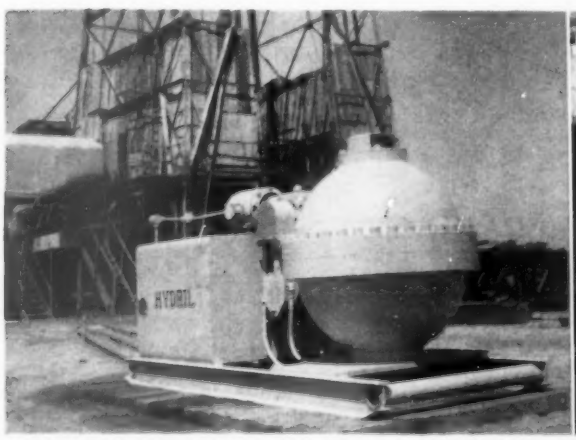
A round trip to change bits at the present depth requires between 14 and 15 hours.

Wire-line maintenance . . . Ohio has followed a well-engineered program of wire-line maintenance in drilling the record breaker. Between 15,000 and 16,000 ft., the program required the line to be moved from 3 to 5 ft. after each round trip and the line to be cut 100 ft. or more after every fourth round trip. Below 16,000 ft., the 1¼-in. wire line was cut 100 ft. or more during every round trip.

Rig on the well is a company-owned National 125, with a 164-ft. derrick on a 14-ft. substructure. The rig previously had drilled a 13,800-ft. dry hole in the Mountain View area near Bakersfield and a deep wildcat in West Branch field in Michigan.

Ohio is drilling the well for its own account, but has received dry-hole money from other Paloma field operators. If the deep test is dry, it is expected to be plugged, since completion in the Sespe formation would disrupt the field's present 40-acre spacing pattern.

DRILLER ON DUTY when depth record was broken was Frank Sherman, shown here.



THIS ACCUMULATOR was used to maintain fluid pressure for hydraulically actuated blowout preventer. Lower blowout preventer has blind rams for complete shutoff. A second has 4½-in. rams to close around drill pipe. Top unit is designed to make complete shutoff around any size pipe.

CONSTANT WATCH was kept on mud weight below 13,818 ft. If weight dropped below 115 lb. per cubic foot, salt water came in. If weight went above 118 lb., the formation began taking mud. Here "Curly" Doan, drilling superintendent, and Clarence Craig, derrickman, weigh sample of mud.

CANADA

Redwater Unit Nearer

Proposed unitization and water-flood project would be biggest in Canada and one of the largest in the world

EDMONTON, Alta.—Unitization and repressuring Canada's largest oil field by water injection awaits only complete agreement on a proposed plan by the 25 operators of Redwater field.

About 35 miles northeast of Edmonton, Redwater was discovered by Imperial Oil, Ltd., in 1948 and contains almost a third of western Canada's oil reserves. The pool covers about 60 sq. miles and its recoverable reserve has been estimated all the way from 500,000,000 to 800,000,000 bbl.

If the plan proposed by Keplinger and Wanenmacher, Tulsa petroleum-engineering firm, is approved, the project will rank as the biggest unitization yet undertaken in Canada and one of the largest water-injection plans in the world. The original plan was announced 2 years ago *(The Oil and Gas Journal, August 9, page 57)*.

Bottom-hole pressures in Redwater have dropped from 1,050 psi. when the field was brought in to 880 psi. in the northern section of the field and about 740 psi. in the southern part. A pressure sink has developed in the south-central part of the field because of what engineers believe is a barrier to the field's natural water influx from the northwest.

Operators have put up $1,000,000 as an initial cost to repressure the field by water injection.

Unit plan . . . The Tulsa firm suggested two stages in determining the oil percentages to go to individual well owners. Under the Keplinger and Wanenmacher plan, producers would share production on the basis of the number of wells owned until 50,000,000 bbl. of oil had been produced.

After the sale of 50,000,000 bbl. by the unit, the participation would be based 75 per cent on the thickness of the pay zone at individual wells and 25 per cent on the ratio of adjusted well factors to the total well factors for all wells producing from the reef.

Approval of the plan would do away with well quotas in the field and the field would be produced by a central committee. The provincial conservation board would decide on a field quota each month.

The plan was stymied at a recent meeting of the operators when Imperial Oil, Ltd., and Royalite Oil Co., Ltd., objected to the over-all plan. Imperial is expected to offer a counter proposal and Royalite argued that porosity should be the big determining factor rather than the thickness of the zone.

The operators have scheduled another meeting for September 3 to attempt to reach complete agreement. Should such an agreement not be reached, it is likely the conservation board will cut production in the field. Present well allowable is 97 bbl. per day with the exception of a few individual edge wells that are undergoing an approved pressure - observation project.

Redwater's 926 wells produce about 80,000 bbl. daily from a Devonian D-3 limestone coral reef at 3,150 ft. with a maximum oil zone thickness of about 200 ft. The field has an active bottom water drive with water influx amounting to about 30,000 bbl. per day.

Because the Saskatchewan River flows through the southern part of the field and its water is suitable for field injection, the plan is believed to be ideally suited for Redwater.

The only other oil producing area in Alberta that has been unitized and is operating on a pool allowable is at Golden Spike, west of Edmonton. The unitized D-3 pool at south Golden Spike is owned outright by Imperial Oil and therefore does not present the problems of complex ownership existing in Redwater.

Petrochem Plant Operating

EDMONTON, Alta. — With pentaerythritol now in production, Canadian Chemical Co., Ltd., is progressing toward completion of its $50,000,000 petrochemical plant here. The plant is now producing yarn, and staple fiber will begin coming off the line in September.

By October, the company expects to begin production of the full line of chemicals, including methanol, propylene glycol, dipropylene glycol, n-propanol and n-propyl acetate. This will mark the first Canadian production of these chemicals from petroleum. Other products will include acetic acid, acetone, acetaldehyde, formaldehyde, and n-butanol.

With its reported capacity for producing nearly 42,000 lb. of pentaerythritol per day, the new plant will meet full Canadian requirements for manufacture of alkyd resin finishes, with enough to spare for export. The penta unit is the first to employ the new continuous process developed by Celanese Corp. of America at its Clarkwood, Tex., research laboratories.

Trans Mountain Finish Near

VANCOUVER, B. C.—A construction crew of 200 men is now working on the final 27-mile Fraser River valley link of Trans Mountain Oil Pipe Line Co.'s 718-mile system between Edmonton and Vancouver.

Canadian Bechtel, Ltd., general contractors for the line, have moved two ditching machines into the Fraser Valley and hope to lay more than a mile of 24-in. pipe a day to complete the line by the first week in September. One ditching machine is working east from Burnaby tank farm and one is working east from Port Mann.

The Edmonton tank farm of the line has been completed and pump stations at the East Edmonton terminal and at Kamloops have been tested. Officials say the Edmonton terminal of the line has storage facilities for 1,500,000 bbl. of crude.

Tanks at the Burnaby farm will be completed by October 1 and the Westridge deep-sea terminal facilities are expected to be finished by October 15.

Ground Broken for Plant

VILLE LaSALLE, Que.—Monsanto Canada, Ltd., has broken ground for a $400,000 petroleum additive plant here and construction will start immediately.

Production of detergents, inhibitor additives, and compounds for lubricants is expected to start by the end of 1953. Production has already started on a new industrial tape made from vinyl film at Barrington Rubber & Plastics, Ltd., a Monsanto Canada subsidiary in Oakville, Ontario.

Pentaerythritol Plant Opens

MONTREAL.—St. Maurice Chemicals, Ltd., has made the first commercial shipment of pentaerythritol from the new Varennes, Quebec, plant. The company, jointly owned by Heyden Chemical Co. and Shawinigan Chemicals, Ltd., synthesizes the petrochemical from synthetic methanol presently obtained from the United States.

The new plant has a capacity for producing 30,000,000 lb. of formaldehyde and 3,000,000 lb. of penta, annually. It marks the first production of the latter chemical in Canada.

Injunction Granted

Order holds Aliso Canyon gas-oil ratios to 4,500:1

LOS ANGELES. — California's gas conservation statutes — the state's only legal means of coping with underground waste of oil—again have been invoked to eliminate a competitive situation alleged to exist in the Aliso Canyon field near here.

In Superior Court here Atty. Gen. E. G. Brown was granted a preliminary injunction requiring producers in the field's Sesnon pool to hold gas-oil ratios under 4,500 cu. ft. per barrel. Excessively high ratios have resulted in the underground waste of 5,000,000 bbl. of oil and threatened to further reduce recoveries by 12,000,000 bbl., the suit claimed.

While all operators in the pool were complained against, Brown said the suit was aimed primarily against one operator. Because of Carlton Beal and Associates' excessive gas withdrawals from an edge lease, other operators have been forced to adopt similar practices to forestall drainage, Brown stated. Ratios of the Beal wells were more than 32,000 cu. ft. per barrel, he declared.

The state's petition declared the defendants first were cited before a Natural Resources Department supervisor who ordered a 4,500-cu. ft. per barrel limit. A board of district commissioners on July 10 upheld the decision almost in its entirety. Since these rulings were being disregarded the state filed for an injunction.

Beal's appeal from the commissioners' ruling and the state's request for a permanent injunction have been combined for hearing before the court September 14.

The situation is similar to that at the Coalinga Nose field, Fresno County, which is now operating under a court-appointed committee. Operators there were cited for unreasonable waste of gas last July 30 *(The Oil and Gas Journal, August 10, page 74, and August 3, page 40)*.

Twenty-seven of Coalinga Nose field's 116 producers were closed August 2 and were restored to production 15 days later on a 100-bbl. daily maximum until September 30. After October 20, the field's output of 45,000 bbl. daily will be allocated on a formula which will penalize high gas-oil ratio producers.

Stocks Still Growing

Imports boost West Coast inventories to new level

LOS ANGELES. — Continued rapid growth of West Coast total oil stocks, largely because of high imports, has increased the stock accumulation about 17,000,000 bbl. since January 1.

The Oil Producers Agency estimates that the rate of increase is slower this month, but it is still believed to be gaining approximately 90,000 bbl. daily. This compares with daily gains of 170,000 bbl. during May, 140,000 bbl. in June and an estimated 130,000 bbl. in July.

The agency's summary of California oil conditions for June and July indicates stock deficiencies that may have existed a year ago have now been overcome. Continued additions can lead only to a burdensome total by the end of the year.

The summary stressed the role of foreign crude imports in the rapid gain of inventories, which at a level of about 116,000,000 bbl., are at their highest point in more than 3 years. Imports during the second quarter averaged about 100,000 bbl. daily, and in June reached the all-time high of 118,000 bbl. During July they are estimated to have declined to about 62,000 daily and during the first half of August are believed to have averaged about 90,000 bbl. daily.

A situation less favorable for importing foreign crudes into California was pictured in a recent address by H. W. Sanders, Union Oil Co. vice president. Speaking before a group of Los Angeles security analysts he stated:

"The recent posted price increases in the Middle East and other world production centers came close to eliminating the favorable price differential that imported crudes have enjoyed, and a small recovery of the now depressed tanker rate would, in our opinion, make crude-oil imports into California less attractive. Present high rates of imports into California may therefore well change before the inventory situation facing the industry becomes burdensome."

Gasoline situation . . . June marked the first time this year that a reduction in gasoline stocks was recorded. Total gasoline supply then was 480,000 bbl., a drop of 20,000 bbl. daily from the May level. The decrease in output resulted in stocks declining 21,000 bbl. daily, or to 22,589,000 bbl. on June 30.

At that time they were 5,559,000 bbl. above those of January 1. Preliminary figures indicate they dropped 6,000 bbl. daily during July, but currently they are estimated to be again slightly increasing.

While some concern has been expressed regarding the level of gasoline stocks and their failure to decline during the second quarter as is normally the case, the situation is generally regarded as not being unhealthy. Stocks a year ago were abnormally low; they are now felt to be adequate.

Finishing Touches to Right-of-Way

An O. R. Burden Construction Corp. tractor, equipped with harrows, smooths out the right-of-way along portion of Service Pipe Line Co.'s Tioga-to-Mandan, N. D., crude line after filling-in operations have been completed. Harrows are used in agricultural areas to put the land into grain-bed perfection, and then a cover crop is planted on the right-of-way if the landowner or tenant desires it.

Line's Oil Deal Lags

Texas cool to bonus price offer for royalty oil to supply proposed $100,000,000, 900-mile pipe line to west coast

AUSTIN.—An offer made nearly 3 months ago to purchase Texas royalty oil at a bonus price to supply a proposed 900-mile, $100,000,000 pipe line from West Texas to California, has not been accepted so far, and indications are that the deal may never be consummated.

West Coast Pipe Line Co., through its recently formed subsidiary, Exchange Oil Purchasing Corp., offered to purchase 15,000 bbl. of royalty oil per day from University of Texas and state school lands, and to pay a bonus of $2,500 for a 2-year option on a 5-year contract to take the oil at 2 per cent above posted field prices *(The Oil and Gas Journal, June 8, 1953, page 65).*

During the first week of June, Bascom Giles, Texas land commissioner, said that the School Land Board probably would reach a decision on the offer within 2 weeks. That decision has not come, and Giles reports now that there are several adverse factors which must be studied first. Among them:

...The 2 per cent bonus will not even be considered. Giles said that "5 per cent would be small enough."

...The $2,500 earnest money "is a pittance in view of the fact we are talking about a $200,000,000 production."

..."I am opposed to the principle of selling all of anything to just one company," Giles said, adding that he had received offers from single companies to purchase all available leases in the tidelands. He has declined to even consider them, he said.

...The bonus offer would be unfair to present leaseholders, who have gone to much trouble and expense in delivering the state's royalty oil, often under adverse conditions.

...Leasing of state lands would be affected in the future if the state accepted the bonus offer, Giles said.

...Promoters of the pipe line have not given assurance that they could provide an adequate gathering system to handle the oil. This problem would not be as difficult in Texas as in New Mexico, Giles said, because the proposed pipe line would run entirely across the latter.

In addition to approval of the State School Land Board, University of Texas' land-leasing board would also have to sanction the deal. Giles said that neither board had set a date for final action on the proposal.

Proponents of the pipe line have estimated that the petroleum industry in Texas would realize an additional $284,000,000 per year, and that new taxes, per year, would amount to about $13,000,000.

Pipe-line plans . . . In June, pipe-line agents for Exchange Oil Purchasing Corp., said that they had concluded an option to buy 17,500 bbl. per day of royalty oil from the State of New Mexico, and had signed up 12,500 bbl. per day of privately produced oil in the Permian basin. These would have provided 45,000 bbl. per day initial throughout for a pipe line designed to carry 150,000 bbl. per day.

Backers of the pipe-line project are understood to believe that it would be feasible to begin construction as soon as about 60,000 bbl. of oil per day had been committed to the line. The proposed line would originate near Midland, Tex., and terminate near Norwalk, Calif.

Opposition . . . In addition to Texas' balk on purchase of royalty oil, other difficulties have arisen which could block the deal altogether. The principal problem is the reluctance of West Coast refiners to agree to purchase Permian basin crude *(The Oil and Gas Journal, April 13, 1953, page 74).*

In fact, it has been estimated in Los Angeles that crude supply may exceed 200,000 bbl. daily this fall, when 120,000 bbl. of Canadian crude begins arriving daily on the West Coast through the new Trans Mountain pipe line.

This is an about face from the situation a year ago, when stocks were low and production was smaller.

Stocks are estimated to have increased at a rate of 65,000 bbl. daily since January 1, and are now believed to be going up at a rate of more than 80,000 bbl. daily *(The Oil and Gas Journal, June 22, 1953, page 143).*

Training Workers for New Plant

Esso Standard Oil Co. follows its regular procedure by conducting a prestartup training program for 16 men who will operate the new isobutylene extraction plant at the company's 148,000-bbl. Bayway refinery, Linden, N. J. The new plant, which is expected to open soon, will produce 51 tons of isobutylene daily. Being shown a model of the plant by its manager, William A. Ludmann (left), are trainees Joseph H. Murphy, Karol M. Marcino, Eugene Millelot, John F. Cordes, and Andrew Christel.

Scurry Briefs Filed

SACROC hoping for Railroad Commission's final decision on field rules for huge Kelly-Snyder flood by October 1

AUSTIN.—Last briefs were scheduled to be filed with the Texas Railroad Commission August 31 in the melee over field rules and injection plans for the world's biggest water flood from the standpoint of acreage—that in Kelly-Snyder field of Scurry County, West Texas.

It is expected that the commission will hear oral arguments about the middle of September, and the Scurry Area Canyon Reef Operators Committee hopes to have the commission's final decision by about the first of October, according to M. Darwin Kirk, chief counsel of Sunray Oil Corp. and chairman of the SACROC legal committee.

Presentation of evidence in support of the two opposing plans for flooding the big field was completed June 26. The SACROC Unit, which takes in nearly 50,000 productive acres in Kelly-Snyder, was approved by the commission January 30 and became effective March 1. Actual water flooding, however, cannot begin until the commission approves field rules. Several million dollars worth of material have been ordered, and a large part of them are already on hand, Kirk said.

Opposing plans . . . Throughout the hearings, SACROC has backed a line-type flood with injection wells down the crest of a ridge in the Canyon Reef formation, together with gas injection in the north end of the field *(The Oil and Gas Journal, May 11, page 82)*.

The SACROC plan is opposed by W. A. Moncrief and associates whose properties are on the east flank of the field. Principal objections were to the crestal water flood and against a proposal for a bonus allowable based on the amount of water injected.

Spokesmen for the Moncrief interests told the commission that adoption of SACROC plan would be ruinous to the reservoir and would result in premature abandonment of their properties. They proposed instead that gas be injected along the crest of the reservoir and water be injected on the edges of the field below the oil-water contact.

Field rules backed by SACROC would: (1) set permissible gas-oil ratio at 1,000 to 1 instead of 2,000 to 1 with all gas injected into the producing formation applied as a credit, (2) grant increased allowables to wells in the field on the basis of an additional 0.2 bbl. of oil for each barrel of water injected—this on the contention that increased production through water injection would merit higher allowables, and (3) transfer to other wells allowables for those converted to injection, those producing gas at a ratio higher than 1,000 to 1, those producing more than 10 per cent water, or those shut in for pressure regulation or other reasons.

Recovery estimates . . . SACROC has estimated an ultimate recovery from the 1,238-well field by primary means of 501,048,000 bbl. and a total recovery under its proposed flood of 1,221,048,000 bbl. Later, Martin G. Miller, consulting engineer who testified for SACROC, said his independent estimates were 667,900,000 bbl. by primary means and 1,462,900,000 bbl. with secondary-recovery operations.

Moncrief spokesmen estimated total recovery of 1,580,000,000 bbl. with the substitute gas and water-injection plan.

Casing Order Issued

AUSTIN. — The Texas Railroad Commission has revealed that in the future operators drilling or deepening oil wells in the state must case such wells to protect all fresh water sands before the wells will be granted an allowable.

Application blanks for permits to drill or deepen now carry this stipulation in red ink. It reads: "No allowable will be assigned to any well which does not have sufficient surface casing to protect all fresh water sands. Where commission rules do not specify surface casing requirements, it will be necessary to contact the Board of Water Engineers, Austin, to ascertain the depth to which fresh water sands must be protected."

In established fields, Railroad Commission rules already are in existence to protect fresh-water sands, but in wildcat areas Water Board clearance is necessary.

Texas to Estimate Reserves

AUSTIN. — The first detailed estimate ever made of Texas' primary and secondary petroleum reserves will be published early next year by the Texas Petroleum Research Committee.

The report will give the results of a 2½-year study of the 3,150 oil fields in Texas in which the agency's scientists made intensive surveys aimed at pinpointing possibilities of increased secondary recovery of oil with improved techniques.

The research committee is supported by legislative appropriation and received $100,000 for the 1951-53 biennium and a similar amount for the 1953-55 biennium.

International Line

Work under way on first Mexico-U. S. crude line

HOUSTON.—Construction has started on the first crude-oil pipe line ever to be laid to import oil into the United States from Mexico.

The 15-mile, 4-in. line of Gabriel Oil Co., Houston, originates from a tie-in with Petroleos Mexicanos' operations in the Mexican State of Tamaulipas, near Reynosa, and runs to a point near McAllen, Tex., where it will tie into an existing pipe line of Continental Oil Co.

Ultimate capacity of the Gabriel line will be about 8,000 bbl. daily, although throughput will not reach this figure initially. Mitchell Darby Construction Co. of McAllen has contract, and about half of the line pipe is already on the site.

H. A. Gabriel, president of Gabriel Oil, told The Oil and Gas Journal that he had to obtain four permits from various sources for construction of the line: (1) From the President of the United States; (2) the International Boundary and Water Commission, Mexican and United States sections; (3) the Corps of Engineers, U. S. Army; and (4) the Texas Railroad Commission.

Another line planned . . . In addition to the Gabriel line, it is understood that approval is being sought by an undisclosed company to construct a crude line from production in Trevino field, Tamaulipas, to a point near Progreso, Tex. Crude would be acquired from the Edwin A. Pauley interests.

Reports are that a pipe-line bridge would be constructed across the Rio Grande which would have a capacity to accommodate three 4-in. lines.

Imports resumed . . . Meanwhile, it was announced in Tampico, Mexico, that that country has resumed exports of oil into the United States, following curtailments earlier by Pemex when crude prices dropped. The Pemex tanker "Azteca" left Tampico last week

with a cargo of 4,117 tons of crude oil, bound for the Port of Brownsville, Tex.

Pemex official Enrique Garcia Naranjo said that Petroleos Mexicanos had lost 100,000,000 pesos (about $11,560,000) during recent months because of curtailed exports to the United States.

Texas Firms Discuss Merger

FORT WORTH.—Plans to merge Cosden Petroleum Corp., Big Spring, Tex., and Southern Production Co., Fort Worth, are being discussed by the two companies, it has been reported here.

Presently, conferences are being held to place relative valuations on stock in the two companies. It has been pointed out that a formal study of companies and their stock may be made before any definite proposals can be submitted to both boards of directors and stockholders.

Cosden, which owns a 20,000-bbl. refinery at Big Spring, is primarily engaged in refining and marketing operations. On the other hand, Southern's chief interest is in crude-oil and natural-gas production.

MEETINGS

A.S.M.E. Program Set

Petroleum division will hold annual meeting in Houston

HOUSTON.—The eighth annual Petroleum Mechanical Engineering Conference of the American Society of Mechanical Engineers will be held here September 28-30.

In addition to 12 technical sessions planned for the conference, those who attend will be offered 10 inspection trips of industrial facilities in the Houston area. One of the trips will cover the entire Houston ship channel industrial area by boat.

One of the conference's technical sessions will be a panel discussion of "The A.S.M.E. Pressure Vessel Code—A joint Effort for Safe Construction."

Papers to be delivered at the session include:

MONDAY, SEPTEMBER 28

Morning:

"Effect of High Strength Casing and Casing Joints on Design of Casing Strings," Sheldon H. Reynolds, U. S. Steel Corp., Houston; "The Triangulation Method for Determining Collapse Change Points in Casing Designs," R. L. Kastor, Shell Oil Co., New Orleans; "Salient Mechanical Features of Houdriflow," R. M. Shirk and D. B. Arden, Houdry Process Corp., Philadelphia; "Fluid Catalytic Hydroforming Units—Their Mechanical Design," R. A. Harang, M. W. Kellogg Co., New York; "Continuous Wax Moulding," Ray Shannon, Magnolia Petroleum Co., Beaumont; "Application of Gas Turbines in Gas Transmission Lines," Steve Sawyer, El Paso Natural Gas Co., El Paso; "Experience with Tri-Fuel Engines in Pipe-Line Service," Leonard P. Meade and Gerald P. Jennings, Phillips Petroleum Co., Bartlesville.

Afternoon:

"Design of Hot Tap Connections In High-Pressure Pipe Lines," A. J. Del Buona, P. L. Vissat and Frank S. G. Williams," Taylor Forge & Pipe Works, New York; "The Mechanical Aspect of Hot Tapping," Burt Ver Nooy, T. D. Williams, Inc., Tulsa; "On the Theory of Drilling Action of Rotary Rock Bits," P. A. Szego, Rice Institute, Houston; "Progress Report on a Fluid Actuated Rotary Percussion Engine," W. H. Cline, Jr., Hughes Tool Co., Houston; "Cast Iron in the Refinery," W. J. Buxton, Standard Oil Co. (Ind.), Whiting, Ind.; "Why Prestressed Concrete in the Refinery?," John S. Bell and Donald R. De Veaux, Esso Standard Oil Co., Bayway, N. J.

TUESDAY, SEPTEMBER 29

Morning:

"The Application of Roller Bearings in Oil-Field Equipment," S. M. Weckstein, Timken Roller Bearing Co., Canton, Ohio; "High Pressure Nitriding and Its Applications to the Petroleum Industry," R. L. Chenault and G. E. Mohnkern, Oil Well Supply Co., Oil City, Pa.; "Some Test Data and Conclusions on Casing Hanger Slip Capacity," E. F. Cooke, Jr., Beaumont Iron Works, Beaumont; "Automatic Self-Sealing Gate Valves—An Analysis of Valve Sealing Methods," Allen F. Rhodes, McEvoy Co., Houston.

Afternoon:

"Microwave Control of Pumping Stations," R. C. Cheek, Westinghouse Electric Co., Baltimore; "Application of Reciprocating Pump Valve Lifters to Closed System Operations," M. T. Nigh and T. S. Llewellyn, Service Pipe Line Co., Tulsa; "New Developments in Compressor Equipment Design and Performance for Natural Gas Transmission Pipe-Line Service," B. T. Mast, Tennessee Gas Transmission Co., Houston; "Packaged Compressor Plants," E. S. McRoberts, J. B. Beaird Co., Shreveport; "Formation of Martensite on Rotary Drilling Lines," C. M. Zerr, Union Wire Rope Corp., Kansas City; "Utilization of Computors for Solutions of Pumping and Drilling Equipment Problems," R. J. Howe and E. N. Kemler, University of Minnesota, Minneapolis.

WEDNESDAY, SEPTEMBER 30

Morning:

"A Capacitance Sensitive Recorder for Pipe-Line Applications," Robert M. Howard and Howard J. En Dean, Gulf Research & Development Co., Pittsburgh; "The Use of Radioactive Isotops in Pipe-Line Interface Marking," J. Kohl and R. L. Neviacheck, Tracerlab, Inc., Berkley, Calif.; "Monel Protection for Offshore Structures," Thomas P. May, International Nickel Co., New York; "The Pipe-Line Welding Standard," A. G. Barkow, Texas Illinois Natural Gas Pipe Line Co., Chicago; "Water Cleaning of Exchangers," W. B. Thomas, The Texas Co., Port Arthur; "Preventive Maintenance of Refinery Compressors," J. R. Ware, Magnolia Petroleum Co., Beaumont; "Scheduling of Refinery Maintenance," Cecil E. Gunter, Gulf Oil Corp., Port Arthur.

Afternoon:

"Power Transmission on Rotary Rigs by Friction Fluid and Electro-Magnetism," M. L. Rizzone, Oil Well Supply Co., Oil City, Pa.; "A Practical Approach to Vibration Problems on Drilling Barges," T. B. Herndon and A. B. Reese, Jr., National Supply Co., Fort Worth; "Introductory Problems Encountered in the Use of Strain Gages," Edwin D. Nuttall and Hale C. Goodrich, United Gas Pipe Line Co., Shreveport; "Monolithic Linings for Vessels and Pipe," W. A. Bradbury, Humble Oil & Refining Co., Baytown, Tex.; "Factors Influencing the Performance of Internal Insulating Linings," C. M. Vogrin and J. J. Murphy, M. W. Kellogg Co., New York.

Petroleum Symposium Set

CHICAGO.—The future of the petrochemical industry and its growth since World War II will be surveyed during a 2-day symposium by the American Chemical Society's division of petroleum chemistry during the Society's 124th annual meeting here September 6-11.

Starting September 9, petroleum chemists will present 21 papers on petrochemicals in the postwar years. The petroleum division also will join with the Society's analytical chemistry division on September 8 to discuss analytical methods in the petroleum industry.

Both symposia will be in the Conrad Hilton Hotel, general headquarters for the A.C.S. meeting, which about 9,000 chemists and chemical engineers will attend.

A.S.M.E. to Hear Papers

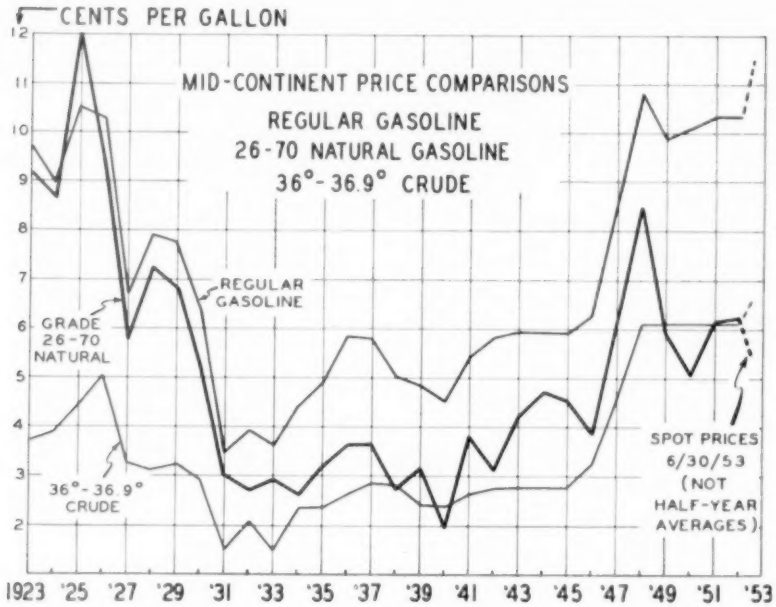
ROCHESTER, N. Y.—Two papers of interest to the oil industry will be presented at the 1953 fall meeting of the American Society of Mechanical Engineers here October 5-7.

Both papers will be presented by W. Sacks, McGill University, at a fuels session scheduled for 9:30 a.m. October 6. The papers are entitled, "Cyclic Catalytic Reforming of Natural Gas" and "Properties of Residual Petroleum Fuels."

N.A.C.E. Program Set

TULSA.—Thirteen technical papers, a pipe-line-corrosion forum, and an oil and gas-transportation panel discussion are included in the program prepared for the South Central region meeting of the National Association of Corrosion Engineers at Tulsa October 7-9.

The technical papers will cover petroleum inhibitors, hydrogen-sulfide corrosion mechanism, cathodic protection of underground pipe lines, corrosion in processing plants, and others.



Natural Jumps Again

Refiners' buying of natural gasoline for blending results in third hike in 2 weeks; still higher postings expected

John C. Casper

THE price of 26-70 grade natural gasoline jumped another ⅜ cent last week, the third increase in 14 days, bringing Group 3 postings to 6.375 cents a gallon.

Postings went up ¼ cent on August 10, were hiked another ¼ cent on August 20, and the latest increase of ⅜ cent was posted August 24. Together they added ⅞ cent to the summer low of 5.5 cents.

Last year saw four increases between July 29 and September 3 totaling 1⅜ cents a gallon. With current demand reported "strong" by suppliers as refiners increased their blending to obtain higher gasoline volatility for the coming fall and winter seasons, there was a likelihood of further increases in natural-gasoline prices.

Routine affair . . . The current increases are not related to the 25-cent raise in the price of crude nor to the subsequent increase in motor-fuel prices. The two increases for natural so far are just parts of the last half of the normal seasonal trend for the year.

Except for years that were abnormal because of unusual demands or because of price restrictions, prices of natural gasoline have started dropping soon after the first of the year, reaching bottom somewhere about the end of the first quarter. Prices stay at the low level until about the middle or last of the third quarter and then start back up. For the past 3 years the top price near the end of the year has been 6.875 cents a gallon for Grade 26-70 on the Group 3 market.

The low price of the year has been 5.5 cents a gallon for 1951, 1952, and 1953. If the Group 3 price for Grade 26-70 goes above 6.875 cents this fall, the change still may not indicate too much influence by the higher crude and product prices this summer. It may mean that natural is again moving toward the price position it formerly held compared with regular gasoline.

The accompanying chart shows price comparisons between annual averages of Mid-Continent prices for Grade 26-70 natural, regular motor gasoline, and 36°-36.9° gravity crude.

Prices used for the chart are: Posted well-head prices for crude, average spot refinery prices for regular gasoline in Group 3, and Group 3 plant prices for Grade 26-70 natural gasoline. Early natural prices were listed as Oklahoma prices.

Trends in prices . . . In the early years, natural-gasoline prices were very near or even exceeded the prices of regular gasoline. Since about 1931 there has been a wider spread between natural and regular. For the 17-year period 1932-1948, the average spread was 1.94 cents a gallon with a maximum of 2.54 cents in the abnormal year of 1940. For the 4-year period 1949-1952 the average spread was 4.34 cents a gallon.

The increase in gasoline prices that followed the crude price rise in June came at a time when natural prices were at the bottom of the annual price cycle. The low of the Group 3 market for regular gasoline moved up to 11.375 cents a gallon, and Grade 26-70 natural continued at a posting of 5.5 cents. This differential of 5.875 cents a gallon is the widest spread that has ever existed between natural gasoline and regular gasoline prices.

The other comparison on the chart shows that annual averages of natural gasoline prices dipped below the postings for Mid-Continent 36°-36.9° gravity crude only twice before the period of depressed natural prices that started in 1949. The average price for 26-70 natural in the 4-year period 1949-1952 was 0.29 cent less than the posting for 36°-36.9° gravity crude.

Industry Briefs

FREEPORT, Tex.—Dow Chemical Co. will complete construction of its new $2,600,000 research center here next month. The center will provide space for the Texas division's organic, chemical engineering, and electrochemical research activities as well as for the analytical laboratory. It also will house research administration offices, a patent office, and a library.

BATON ROUGE. — Crude-oil-production allowables for Louisiana have been raised slightly for September. The state Conservation Commission has set output at 703,735 bbl. daily, compared with 702,471 bbl. for August, an increase of 1,264 bbl. daily.

WICHITA.—The Kansas Corporation Commission ordered a token cut in daily production allowables for September, putting its stamp of approval on earlier action by the Texas Railroad Commission. T. A. Morgan, conservation director for the Kansas commission, said Mid-Continent crude production is too high generally and recommended Kansas wells be held to 310,000 bbl. daily, a reduction of 10,000 bbl. daily from August allowable.

Top Court Gets Appeal

Phillips asks review of appellate court decision placing firm under Natural Gas Act; states file supporting brief

Bertram F. Linz

WASHINGTON.—The issue of Federal Power Commission jurisdiction over "arm's-length" sales of natural gas by producers was laid before the Supreme Court August 20.

A petition for review of the District of Columbia appeals court decision holding Phillips Petroleum Co. to be a natural-gas company under the Natural Gas Act was filed by Phillips, and at the same time the court granted a motion of the Department of Justice to extend to October 19 the time in which to file its petition for review on behalf of the commission. The additional time was needed, it was explained by the Solicitor General, to enable the department "to evaluate the conflicting positions of interested parties."

States enter case . . . The Phillips petition was supported by a brief filed with the court jointly by the states of Texas, Oklahoma, and New Mexico asserting that FPC control would jeopardize the expansion of natural gas supplies and the states' conservation programs.

The states contended that the extension of federal control required by the lower court decision would ultimately have a serious effect on the interests of consumers by reducing the supply of natural gas. This would come about through the "impairment of state conservation measures and because federal regulation will discourage independent producers and gatherers from selling gas in interstate commerce," the states' brief said.

It was also asserted that FPC regulation would disrupt the unitization, proration, ratable taking of gas, saving of casing-head gas and well-spacing aspects of conservation programs developed by the states. At the same time it was pointed out the federal Government has no established conservation program which would remedy that situation.

Old issue . . . The Phillips case involves an issue which has long been a subject of controversy in both the FPC and Congress, arising out of ambiguities in the phrasing of the Natural Gas Act with respect to an exemption from commission jurisdiction which Congress wrote into the bill for independent producers and gatherers.

The commission itself, in this case, held that Phillips' gas operations were not such as to make it subject to the act, but public authorities in Michigan and Wisconsin challenged the decision in the courts where the commission was reversed.

End to TEL Order

WASHINGTON. — Revocation of PAD Order No. 4, setting minimum requirements for the tetraethyl lead content of commercial aviation gasoline, is expected to take effect October 1.

A canvass of refiners by the Petroleum Administration for Defense disclosed that only two expected hardships would result from withdrawal of the order. But PAD officials are confident that supplies of components that will be required in place of TEL are available at points from which they can be readily secured.

Major beneficiaries of eliminating the requirement for use of not less than

Site Work Pushed at Mandan Refinery

One storage tank has been completed and two others are near completion at the site of the new 30,000-bbl. Standard Oil Co. (Ind.) refinery at Mandan, N. D. These tanks initially will be used to store products coming through a 10¾-in. pipe line being laid between the refinery and Moorehead, Minn. The products line will be completed in December, nearly a year before the refinery will be ready for operation. Site for process units, where piping and foundation work is progressing, is between tankage site in foreground and lagoon.

4 cc. of TEL per gallon for domestic and 4.6 cc. for export avgas, will be the commercial airlines, which have complained that the higher TEL content increased maintenance costs.

Products Supply Up

June secondary inventories 2,842,000 bbl. over May

WASHINGTON.—Secondary inventories of major petroleum products increased 2,840,000 bbl. during June but at the end of that month were approximately 258,000 bbl. under those the same date last year.

The monthly Census Bureau report estimated June 30 stocks at 46,980,000 bbl. against 44,138,000 bbl. on May 31 and 47,239,000 bbl. June 30, 1952.

Over-all stocks increased during June in all but one of the five Petroleum Administration for Defense districts, as follows: District 1, 20,073,000 bbl. against 17,456,000 bbl. in May; District 2, 16,701,000 bbl. against 16,600,000 bbl.; District 3, 5,055,000 bbl. against 5,094,000 bbl., and District 5, 3,630,000 bbl. against 3,431,000 bbl. Stocks in District 4 declined to 1,521,000 bbl. from 1,557,000 bbl.

SECONDARY INVENTORIES OF MAJOR PRODUCTS
(Thousands of barrels)

	June 30, 1953	May 31, 1953	June 30, 1952
Gasoline:			
Dist. 1	5,240	5,243	5,464
Dist. 2	8,671	8,750	7,841
Dist. 3	2,946	2,838	3,078
Dist. 4	967	1,003	870
Dist. 5	2,161	2,096	2,102
Total	19,985	19,930	19,335
Kerosine:			
Dist. 1	2,727	2,342	2,680
Dist. 2	2,622	2,596	2,904
Dist. 3	677	714	690
Dist. 4	88	89	97
Dist. 5	120	95	117
Total	6,234	5,836	6,488
Distillate:			
Dist. 1	7,953	6,007	7,382
Dist. 2	4,347	4,329	4,608
Dist. 3	861	997	963
Dist. 4	460	459	389
Dist. 5	1,261	1,156	1,249
Total	14,882	12,948	14,591
Residual:			
Dist. 1	4,153	3,864	4,720
Dist. 2	1,061	925	1,237
Dist. 3	571	545	724
Dist. 4	6	6	8
Dist. 5	88	84	115
Total	5,879	5,424	6,804
Major products:			
Dist. 1	20,073	17,456	20,246
Dist. 2	16,701	16,600	16,590
Dist. 3	5,055	5,094	5,455
Dist. 4	1,521	1,557	1,364
Dist. 5	3,630	3,431	3,583
Total	46,980	44,138	47,238

Heavier inventories were reported for all four of the major products, with gasoline stocks at 19,985,000 bbl. against 19,930,000 bbl.; kerosine, 6,234,000 bbl. against 5,836,000 bbl.; distillate fuels, 14,882,000 bbl. against 12,948,000 bbl., and residual fuels, 5,879,000 bbl. against 5,424,000 bbl.

The bureau estimated secondary storage capacity in all districts except District 5 to amount to 86,300,000 bbl. as of April 30, last, when the 39,165,000 bbl. of products then stored in those districts represented approximately 47 per cent of capacity.

Details of the June 30 stocks, compared with preceding months, are shown in the accompanying table.

Tanker Plan Ruled Out

WASHINGTON.—The General Accounting Office has ruled out Commerce Department proposals to offer tanker owners credit against new, modern ships if over-age vessels are turned in to the Government.

Any deals made to carry out a plan for encouraging new tanker construction, the department was told, must be on a basis of a price for old vessels that is fair and reasonable to both the seller and the Government but without any element of subsidy.

The Merchant Marine Act lays down three bases on which the Government can take over old vessels—their depreciated value based on a 20-year life, the scrap value in American and foreign markets, or the market value for operation in world trade or in American foreign or domestic trade.

However, the Government can take world market prices for tankers into consideration in fixing the price it will pay for a vessel and also can make allowance for any improvements the owner may have made to it.

Oil Reserves Hearings Set

WASHINGTON.—Investigation of the petroleum self-sufficiency of the United States in the event of war will be started next month by a 5-man Senate subcommittee headed by Senator George W. Malone of Nevada.

Staff studies, which have been under way for some weeks, will be implemented by testimony at hearings scheduled by Malone to determine how self-sufficient the U. S. can become in producing and securing oil, and certain other strategic and critical minerals and materials "within an area which we can defend."

The hearings are expected to go into questions of Canadian and Mexican resources, and probably into the possibilities of securing Venezuelan oil to supplement Northern Hemisphere supplies in wartime.

Refiners Criticized

Price hike termed shot in the arm for inflation

WASHINGTON.—The effects of increases in crude and product prices upon the administration's effort to restore the "hard dollar," rather than the merits of the industry's action to recover increased costs, is the basis for his contention that the higher prices were "unwarranted," Rep. John W. Heselton of Massachusetts disclosed last week.

In a letter to Elmer E. Batzell, general counsel for the Independent Refiners Association of America, Heselton warned that any legislation enacted by Congress for control of the oil industry will be attributable to the industry's own actions.

"Apparently you are not concerned with the effect of the price increases upon the efforts of the administration to prevent further inflation and further decreases in the value of the dollar," Heselton wrote. "I am."

Furthermore, Heselton said, "if it becomes necessary to regulate the production, handling, and disposition of this important natural resource, it will be because the industry has brought about conditions which require such regulation in the interests of the national economy and of national security."

Charges answered . . . Heselton's charges were immediately answered by Batzell, who asserted that Congress itself will be responsible for a "significant" step to eliminate competition if it exerts pressures forcing a price squeeze on independent refiners which "can only have the ultimate consequence of driving out of the market place a vigorous, competitive element in the petroleum industry."

"Naturally the independent refiner does not want to contribute to inflation," Batzell wrote Heselton. "It is inflation which has caused the increase in costs which has reduced him from a pre-Korea profit position to a post-Korea loss. To chastise him now for attempting to hold his own against the inflationary pressures which operated while his price was rigidly controlled is tantamount to saying that he

WATCHING WASHINGTON

Bertram F. Linz

Research Budget Due Knife

The Eisenhower administration is now engaged in a third round of cost-cutting which may further curtail government activities relating to oil and gas.

The first round in the move to reduce government spending to a realistic level was the President's slashing of Truman-approved appropriation estimates of $69 billion. The second was the further shaving of Eisenhower's estimates by Congress. The two pared slightly more than $14.5 billion from original estimates, and actual appropriations this year were held to $54.5 billion.

In the drive for economy, Navy plans for oil development in Alaska and Teapot Dome were abandoned, the Bureau of Mines synthetic liquid fuels demonstration plant at Louisiana, Mo., was closed, and Interior Department research on synthetic fuels, oil, and gas was sharply restricted.

Even these heavy cuts in spending, however, failed to balance the budget, and in view of an anticipated heavy deficit for the year ending next June 30, President Eisenhower asked Congress for a $15 billion increase in the permissible national debt limit. Congress refused to grant this request, and the President has ordered the heads of all federal departments and agencies to pare the fat off every project.

Interior Department hatchet men are now making a new survey of all activities. The Reclamation Bureau will be a prime target but there are possibilties that oil and gas research will be put on a starvation diet until the Government can use black ink instead of red on its financial statements.

Probe Seeking Weak Spots

The Department of Justice is probing the oil industry at a number of points, apparently with a view to finding a weak spot against which it can launch an antiturst attack.

This was indicated recently by Asst. Atty. Gen. Stanley N. Barnes, head of the antitrust division, who pointed out there are a number of practices regarding which the department has received complaints.

In addition to the recent much-publicized increases in the prices of gasoline and heating oils, the department has received complaints on "full line" forcing under which service stations must sell full lines of tires, batteries, and accessories; alleged discrimination by pipe-line owners against some classes of users, exclusive-dealer contracts with service stations, alleged efforts of refiners to induce retailers to reduce their markups, and charges that state conservation agencies have helped bring about an artificial price structure.

The department will not break out with a rash of cases all of a sudden, however. It takes a lot of time and effort to make an investigation and prepare a case for filing and trial.

If all the complaints involving oil were taken up, Barnes indicated, the antitrust division wouldn't have much time or personnel for the policing of other industries.

Population Races Resources

Soaring population, as well as a rising level of living, will be a major factor in the world's raw-materials situation in the future.

The world's population is growing at the rate of something over 25,000,000 a year—in the United States alone over 2,000,000—but the demand for raw materials is increasing even faster.

The ever heavier drain on natural resources was brought out last year by the Paley materials policy commission. This month the Population Reference Bureau took up the subject, pointing out that while the United States still keeps oil discoveries ahead of production, it does not alter the fact that we have just so much oil and no more.

"The multiplication of the earth's people is a dynamic which is startling to comprehend," said the bureau. "It shows little tendency to stop while new processes are being invented or perfected to provide food and other needs."

The rapid rate of population growth continually increases the demand base, and barring disasters world population will continue to grow at a very rapid rate for at least a generation. It is a definite challenge to the oil and other industries based on natural, unrenewable resources.

should be permanently penalized, even to the extent of his very existence, for holding his prices down at a time when steel, equipment, and labor costs were being permitted steadily to rise.

"As matters stand today the independent refiner is fighting for his life."

Security Peril Cited

FOA warns against lagging effort in defense buildup

WASHINGTON.—President Eisenhower last week endorsed a warning by the Foreign Operations Administration that there can be no slackening in the effort to build up the defense power of the United States and the other free nations until conditions for genuine peace have been firmly established.

The warning was sounded in a report by the FOA on its operations during the first half of this year. The President's endorsement was in his letter transmitting the report to Congress.

The administration's concern with the defense program was seen in Washington as giving point to a new study of the oil industry's capacity to produce aviation alkylate outlined by the Petroleum Administration for Defense.

The aviation gasoline situation has been a continuing problem over the past 3 years. Currently, it is the one bad spot in the military oil supply, with only about 10,000 bbl. of a 30,000 bbl.-a-day expansion program so far covered.

Soviet threat remains . . . In its report the FOA warned there is no real evidence the soviet threat has diminished or will diminish within the foreseeable future. The new mutual-security agency, however, avoided any prediction of the type frequently resorted to in the Truman era that some specified future date would present the greatest danger.

"Just as we have no evidence that the threat to our security has diminished," the FOA admitted, "neither can we predict a date on which this threat may reach maximum proportions."

There was no suggestion in either the report or the President's letter that the defense program should be speeded up at the expense of the civilian economy. On the contrary, Congress was told, "a judicious balance must be maintained between the military effort and economic stability," not only in this country but in our "partner" nations as well.

To develop and maintain the strength of the democratic nations, the report said, there must be a greater degree of

cooperation among the free countries, with expanding trade and greater investment of private capital, especially in the underdeveloped areas.

Oil Taxes Exceed $1 Billion

WASHINGTON.—Treasury revenues from the four federal oil taxes topped the billion-dollar mark in fiscal year 1953 for the first time.

The $1,007,469,000 collected represented a net increase of $164,988,000 over the 1952 fiscal year, the Internal Revenue Bureau announced last week.

Receipts for the year included $890,679,000 from gasoline against $713,174,000 in the preceding year, an increase of $177,504,000 or 24.9 per cent; $28,378,000 from pipe-line transportation against $26,881,000, an increase of $1,496,000 or 5.6 per cent, and $15,091,000 from diesel oil against $7,138,000, an increase of $7,953,000 or 111.4 per cent.

Against these increases, collections from lubricating oils, which have been declining steadily over a long period, dropped to $73,321,000 from $95,286,000, a loss of $21,965,000 or 23.1 per cent, the bureau disclosed.

Two Lease Sales Planned

WASHINGTON. — The Bureau of Land Management will sell oil and gas leases on 1,840 acres of New Mexico and California lands next month.

The bureau will open bids September 16 for leases on seven parcels aggregating approximately 1,780 acres in the known geologic structure of the San Juan field near Farmington, N. M., and on September 23 will open bids on a lease of 60 acres in the Sunset field southwest of Bakersfield, Calif.

The leases will be awarded to the qualified bidders of the highest cash bonuses on the usual terms and royalties.

INDUSTRY AFFAIRS

Line Bids Open

Project completion date set for September 1955

SEATTLE.—Bids on the 615-mile military pipe line from Haines to Fairbanks, Alaska, will be opened October 14, and work is expected to start immediately after the contract is awarded in order to meet the September 1955 completion date of the line.

The U. S. Engineers advertised for bids last week. The project is open to contractors in the United States and Canada.

The project calls for a complete petroleum-products system to supply interior Alaska's military installations. The general route will follow the Alcan highway through 284 miles of Canadian territory.

The project will involve furnishing and laying 615 miles of 8-in. welded steel line, construction of a terminal wharf at Haines, five complete pumping stations with four more supporting facilities, a terminal at Fairbanks, two intermediate facilities and two tank farms.

About 180 miles of the line will be buried and another 435 miles surface laid, much of it on permafrost, the perpetually frozen surface of the Arctic.

The line's 50-ft. right-of-way crosses mountains, rivers and miles of open land. It will pass near the 14,000 to 16,000-ft. peaks of the St. Elias and Wrangell mountain ranges and north of Whitehorse it is scheduled to cross 8½ miles of Kluane Lake which is 290 ft. deep. An alternate route around the lake offered bidders would add 6 miles to the line's length.

Engineers estimate 42,000 tons of pipe will be needed to complete the line. Contractors are expected to make use of the coming winter months in clearing right-of-way and stringing pipe.

Plans, specifications, and bid forms may be secured by contacting the office of the Alaska district engineer at Anchorage or the Seattle branch of the Alaska District Corps of Engineers.

Sinclair Buys 28 Wells

Sinclair Oil & Gas Co. has acquired a 90 per cent interest in 28 producing wells in the Fort Zarah pool, Barton County, West Kansas.

The firm bought a 40 per cent interest from Arthur Al Seeligson, San Antonio independent producer, and a 50 per cent interest from the Graham-Messman-Rinehart Oil Co. of Wichita. William Graham of the oil company retained a 10 per cent interest.

The wells, located on four leases on 632 acres, average pumping 600 bbl. daily from the Arbuckle and Kansas City limes.

Gas-Line Details Disclosed

DETROIT.—Details of construction plans for a 1,000-mile, 30-in. natural-gas pipe line from Louisiana Gulf Coast fields to Detroit were disclosed recently by William Woolfol, chairman of American Louisiana Pipe Line Co., formed to build the line by American Natural Gas Co.

In a letter to stockholders, Woolfol said the construction program will take about 3 years and cost approximately $200,000,000. The company chairman said financing of the program will be undertaken "step by step" as funds are needed without "dilution of per share earning power."

Woolfol said the company plans to raise funds by issuing senior securities of the various operating units, retaining earnings and the sale of $25,000,000 additional in common stock.

The company will seek Federal Power Commission authority for the line's construction next month.

Ohio to Offer Stock

FINDLAY, Ohio.—Ohio Oil Co. plans to sell soon 303,080 shares of stock in Mountain Fuel Supply Co., Salt Lake City, in order to reduce its holdings in Mountain Fuel to less than 10 per cent.

Ohio now owns 480,857 shares of Mountain Fuel. The proposed sale will remove the company from the status of a statutory holding company under the Public Utility Holding Company Act of 1935.

The sale, just announced by Ohio, has been rumored as being planned for about 3 years. A company announcement said the stock sale will be accomplished "in view of the company's position" under the holding-company act.

Mountain Fuel reportedly has filed a registration statement with the Securities and Exchange Commission covering the public stock offering under consideration.

ROCKY MOUNTAIN

Montana Sets Rules Hearing

GREAT FALLS, Mont.—The newly created Oil and Gas Conservation Commission of Montana will hold a public hearing September 22 to adopt a set of conservation regulations and rules of practice and procedure before the commission.

The hearing is scheduled for 9 a.m. in the governor's reception room at the state capitol in Helena.

The commission has announced it will welcome testimony "of any interested person" at the hearing. A tentative form of general rules and regulations and also rules of practice and procedure has been prepared and may be obtained from the commission.

Crude Output Hits New High

Free World production shows 100,000-bbl. daily increase to set oil output record for the third consecutive month

Dahl M. Duff

FREE WORLD production of crude oil established another record during June as a result of gains in output both from fields in the United States and abroad.

The daily average for the month of nearly 11,880,000 bbl. daily represented an increase of approximately 100,000 bbl. daily, or 0.8 per cent, over production during May. During the first 6 months of this year, the daily average production of the non-Communist world was 11,736,000 bbl. daily.

The changes in crude production from May to June in countries outside the United States were relatively small. The over-all net change was for an increase of some 43,000 bbl. daily. The largest gain of any country was in Canada, up 22,000 bbl. daily to a new high of 224,000 bbl. daily.

Preliminary figures showed United States production during June at 6,445,000 bbl. daily. This represented an increase of about 55,000 bbl. daily over the average the previous month.

Foreign crude-oil production increased each month from February to June. The non-Communist foreign output in June represented a gain of 292,000 bbl. daily over June 1952. June production for the Free World, including estimated United States output, was 540,000 bbl. daily, or 4.8 per cent, more than the corresponding month of 1952.

Canada . . . Canadian crude production jumped sharply under the impact of summer demand and the renewed shipping on the Great Lakes. The seasonal variations that characterize western Canada's production will be largely eliminated with the completion of the British Columbia and Sarnia lines which are designed for year-round operation. The 224,000 bbl. daily in June compares with a previous autumn high of 198,000 bbl. daily last October. Canada's May production was 202,000 bbl. daily.

Mexican production, as estimated for June, rose slightly from the sharply depressed level to which output in this country dropped during May. Mexican oil production has suffered from the same market conditions that caused curtailed output in Venezuela during the first half of the year.

Latin America . . . Venezuelan production was up nearly 10,000 bbl. daily during June as compared with May, but the daily average for this second largest oil producing country was still some 75,000 bbl. daily below June 1952 and about 50,000 bbl. daily under the average for all of 1952.

For the first 6 months of this year, Venezuelan production was 1,747,000 bbl. daily. This compares with the 1,803,900 bbl. daily produced during 1952. By weeks, production in Venezuela during June was: 1,741,100 bbl. daily for the week of June 8; 1,756,100 bbl. daily for the week of June 15; 1,733,600 bbl. daily for the week of June 22; and 1,747,000 bbl. daily for the week of June 29.

Production in Colombia was virtually unchanged from the previous month. By concessions, production was (crude only) De Mares, 35,381 bbl. daily; Yondo, 36,831 bbl. daily; Pesado (Barco), 18,271; Liviano (Barco), 7,112 bbl. daily; Dificil, 1,135 bbl. daily; Cantagallo, 1,420 bbl. daily; Guaguaqui, 5,394 bbl. daily.

West Germany showed another slight increase during June to reach a daily average of 42,400 bbl. The preliminary reports on West German production showed that output in June for the first

CRUDE-OIL PRODUCTION

(Daily average in thousands of barrels)

Country—	June 1953	May 1953	June 1952
W. Hemisphere:			
Argentina	78.0	77.3	67.5
Bolivia	1.3	1.3	1.5
Brazil	2.8	2.8	2.0
Canada	224.0	202.0	180.0
Chile	3.0	3.1	2.2
Colombia	105.5	105.5	108.5
Cuba	0.1	0.1	0.1
Ecuador	8.2	8.2	7.6
Mexico	182.1	177.6	217.4
Peru	44.0	44.0	45.1
Trinidad	60.8	62.0	57.6
Venezuela	1,749.1	1,739.2	1,824.6
Total	2,458.9	2,423.1	2,514.1
Europe & Africa:			
Algeria	1.9	1.8	0.6
France	7.2	7.1	7.3
Fr. Morocco	2.1	2.1	2.1
W. Germany	42.4	41.8	34.4
Italy	2.0	1.9	1.2
Netherlands	15.8	16.2	13.7
Egypt	46.5	46.7	45.0
United Kingdom	1.1	1.1	1.1
Total	119.0	118.7	105.4
Middle East:			
Bahrein	30.1	29.9	30.0
Iran	30.0	32.0	31.0
Iraq	588.7	584.3	418.6
Kuwait	906.5	899.6	777.0
Qatar	90.8	90.2	67.0
Saudi Arabia	880.9	887.4	899.0
Turkey	0.3	0.3	0.3
Total	2,527.3	2,523.7	2,222.9
Other Asia:			
British Borneo	102.0	98.3	104.3
Burma	2.5	2.5	2.4
India	6.0	6.0	6.0
Indonesia	204.0	204.0	172.3
Japan	5.7	5.8	6.0
New Guinea	4.6	4.9	4.5
Pakistan	3.9	4.0	3.9
Total	328.7	325.5	299.4
Total non-Communist, foreign	5,433.9	5,391.0	5,141.8
United States	6,445.0	6,389.9	6,197.2
Total, free world	11,878.9	11,780.9	11,339.0
Est. Russia and E. Europe:			
Austria (Soviet Zone)	65.0	65.0	55.0
Romania	80.0	80.0	80.0
Russia	1,035.0	1,035.0	935.0
Other Communist	33.8	33.8	26.2
Total	1,213.8	1,213.8	1,096.2
World total	13,092.7	12,994.7	12,435.2

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates have been made for certain other countries, particularly in Southeast Asia, for which completely current reports are lacking. Data for earlier months have been revised where appropriate. Other Communist includes China and Yugoslavia along with the Soviet satellite countries in Europe.

TREND OVER LAST YEAR
(Thousands of barrels daily)

	Western hemisphere less U. S.	Middle East	Total non-Communist foreign
1952—			
July	2,495.0	2,126.1	5,018.7
August	2,425.5	2,091.7	4,921.7
September	2,417.8	2,168.2	4,994.8
October	2,455.8	2,175.1	5,047.2
November	2,504.9	2,174.7	5,098.7
December	2,561.3	2,092.1	5,075.0
1953—			
January	2,472.8	2,252.3	5,152.2
February	2,407.2	2,258.4	5,096.8
March	2,412.5	2,266.1	5,104.8
April	2,448.1	2,426.8	5,306.6
May	2,423.1	2,523.7	5,391.0
June	2,458.9	2,527.3	5,433.9

time reached the 6,000 metric tons per day level. During the first half of the year, production totaled 1,024,000 tons, or about 40,000 bbl. daily. By areas, production during June was (in metric tons), Emsland, 73,310; Weser-Ems, 12,849; Hanover, 76,170; Holstein-Hamburg, 15,268; Upper Rhine Valley, 2,393.

Middle East . . . Although the increase in production in the Middle East in June was of a relatively minor nature, it gave the region its sixth consecutive monthly record. The average for the Middle East for the first half of 1953 was 2,376,000 bbl. daily. This represents an increase of 14.1 per cent over the 2,082,000 bbl. daily average for all of 1952.

Kuwait's production in June averaged 906,500 bbl. daily, up about 7,000 bbl. daily from the previous month. This new record represented the first time any of the Middle East producing countries went above 900,000 bbl. daily. Production in Saudi Arabia was down about 6,500 bbl. daily. During the first 6 months, Kuwait averaged 839,500 bbl. daily, while Saudi Arabia produced 834,500 bbl. daily during the same period.

Production in Iraq during June increased only slightly. The total included 490,300 bbl. daily from Kirkuk, 58,800 bbl. daily from Zubair, and 27,600 bbl. daily from Ain Zalah. Production in Qatar rose about 600 bbl. daily over May to set a new high of 90,800 bbl. daily for this shaikhdom.

EUROPE

French Products Line Opened

The 140-mile, 10-in. Le Havre-Paris pipe line is now in operation delivering products to the French capital, but additional work is continuing on terminals and branch lines in the Paris area.

The line *(described in a detailed article in The Oil and Gas Journal, December 22, 1952, page 197)* is operated by the government-supported company, Soc. des Transports Petroliers par Pipe Line (T.R.A.P.I.L.). It was 2 years in construction.

Another section of main line to be built this year is from Le Havre to the Gonfreville l'Orcher refinery of Cie. Francaise de Raffinage. Originally one of the existing lines from Le Havre to the C.F.R. refinery was to be connected to the main line at Gonfreville, but it was later decided to connect the main line directly with Le Havre and build an additional station at Le Havre.

The final phase of the project consists of construction of the main line beyond St. Ouen to the Juvisy terminal around the north and east sides of Paris to serve St. Denis, Aubervilliers, Ivry, and Vitry-le-Roi. Work on this section, including branch lines and terminals, has started.

New Sicily Wells Slated

Pacific Western Oil Corp. and Charles Wrightsman have acquired an interest in several acreage blocks in West Central Sicily and are preparing to initiate an exploratory program in the near future, according to reports in industry circles.

The rig with which Pacific Western and Wrightsman drilled a recent unsuccessful wildcat in Lebanon west of Beirut is reported being moved to Sicily.

Anglo-Iranian and Gulf are now actively exploring separate concession holdings in Sicily. American International Fuel & Petroleum Co. (Gulf) is now at about 5,000 ft. in its first wildcat test on the outskirts of Ragusa. D'Arcy Exploration Co., Ltd. (Anglo-Iranian) is reported to have made a location near Vittoria to the west of Ragusa. Mediterranean Oil Co., a joint subsidiary of Gulf and MacMillan Petroleum Corp., is scheduled to drill next year on a concession originally granted to MacMillan and since transferred to Mediterranean Oil.

Reliable reports in the industry are that Pacific Western and Wrightsman also have been studying the exploration possibilities in Egypt.

British Well Going Deeper

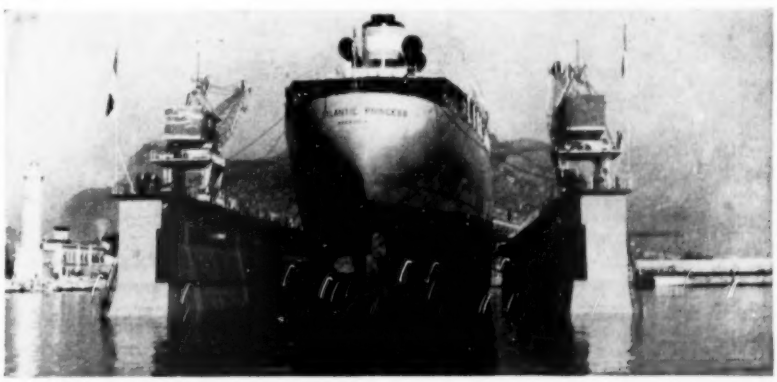
D'Arcy Exploration Co., Ltd. (Anglo-Iranian) has taken its exploratory well at Screveton, south of Newark, Nottinghamshire, England, to 3,501 ft. without trace of oil. The hole is to be drilled another 100 ft. before a final core is taken.

Another D'Arcy exploratory well in England, at West Drayton, near Tuxford, has reached 1,942 ft. toward a 3,500-ft. objective. This location is near a 1940 hole drilled by a coal company which had a show of oil. D'Arcy contracted seismograph work over about 30 sq. miles east of Nottingham and over an area of similar size between Sutton and Tuxford, north of Newark.

Belgian Exploration Planned

The Belgian Shell Co. (Royal Dutch-Shell) and Cie. Financiere Belge des Petroles (Petrofina) have applied to the Belgian Government for exploratory rights in two provinces in the northern part of the country.

Both companies are reported to have asked for the same area covering about 266,000 acres in the provinces of Ant-



New Floating Dock Handling Tankers at Palermo

The busy oil tanker traffic in the central Mediterranean now has available the facilities of this new floating dry dock in the port of Palermo, Sicily. Its commissioning reflects the efforts of Italian shipping interests to take advantage of growing petroleum trade. The dry dock is operated by Soc. Bacini Siciliana and can accommodate ships up to 30,000 tons deadweight. During 1952, a total of 251 tankers crossing the Mediterranean called at Palermo for repairs. First vessel to use the new dock was the Atlantic Princess shown here.

werp and Limburg adjacent to the frontier with the Netherlands.

The Belgian Government has not yet made a decision on whether a concession will be granted and to which company. The area involved comprises the somewhat small Belgian portion of the main sedimentary basin that extends across northern Europe.

Exploratory work has been under way across the border in the Netherlands since the end of the war by Nederlandse Aardolie Mij., a subsidiary of Jersey Standard and Royal Dutch-Shell. A few months ago, this company was reported to have had a discovery in a test well in the southwestern part of the country.

French Refinery Adds Unit

Work is scheduled to get under way in the near future on a new platforming unit at the l'Avera, France, refinery of Soc. Generale des Huiles de Petrole, B.P., the French affiliate of Anglo-Iranian Oil Co., Ltd.

The platformer, which will have a capacity of 250,000 tons a year, or about 5,000 bbl. daily, is the same as the unit now under construction at the Anglo - Iranian refinery in Hamburg, Germany. It was originally planned to install the French unit at S.G.H.P.'s Dunkirk refinery, but the decision was later made to locate it at l'Avera where access is easier to Mediterranean markets.

New facilities also are being erected at three other of the six continental refineries owned by Anglo-Iranian and its associates. Catalytic cracking and catalytic polymerization units are under construction at the Antwerp refinery, a new distillation unit which will bring capacity to about 25,000 bbl. daily is being erected at Hamburg, and the Schindler refinery in Germany is being improved with the construction of a new furfural plant for lubricating oil.

LATIN AMERICA

New Refinery Urged

Colombian government committee recommends building of 25,000-bbl. plant on Caribbean; private capital sought

CONSTRUCTION of a new 25,000 bbl. daily refinery on the Caribbean Coast, encouragement to new companies to enter the marketing field, and all possible assistance by the government to private exploration and development have been recommended by a Colombian government committee which was appointed early this year to study the country's oil situation.

Private capital, the committee said, should be sought to build the new Caribbean refinery, but if private financing is not found, then the government should provide the necessary funds. The committee recommended that a new corporation be formed, also preferably with private capital, to build new pipe lines needed in the country and operate the existing products system.

At the same time, however, the committee's report recognized that investment in refineries and pipe lines offer less return than many other enterprises in Colombia and said that steps by the government should be taken to encourage such investments.

The proposed 25,000-bbl. daily refinery on the Caribbean Coast would supply the northern and western parts of the country which are now importing products from Aruba. Any surplus would be available for export. By 1960, the committee estimated that total consumption in Colombia would amount to 46,135 bbl. daily, up 86 per cent over 1952.

The committee's consumption estimates are included in the accompanying table (in barrels daily):

	1952	1960	Per cent increase
Aviation gasoline	1,073	1,100	3
Motor gasoline	10,700	21,940	105
Vaporizing oil	625	1,525	144
Kerosine	1,700	3,810	124
Distillates	2,700	5,675	110
Fuel oil	8,050	12,085	50
Total	24,848	46,135	86

Still importing products . . . Despite the fact that current consumption is less than a quarter of present crude-oil production of about 110,000 bbl. daily, Colombia is forced to import nearly half the products it needs. Last year these petroleum imports cost the Colombian economy $13,000,000. The situation is due to the fact that the country's only large refinery at Barrancabermeja can supply economically only the central and southern parts of the country. There also is a disparity between the refinery's production of individual products and the country's requirements.

In its report, the committee noted that the modernization program now being carried out at Barrancabermeja will contribute toward solving this problem, but said climbing petroleum demand will make a second large refinery necessary. The program to expand Barrancabermeja to 35,000 bbl. daily is due for completion next year.

At present, only one company, Esso Colombiana, S. A., a subsidiary of International Petroleum Co., Ltd., distributes products in Colombia. The committee said that steps should be taken to encourage other companies to enter the trade. Completion of the refinery expansion at Barrancabermeja and competition in marketing would allow the removal of the price controls now maintained by the government.

Assistance urged . . . The committee also said that the government should continue to do everything possible to assist exploration and development by private interests. Foreign companies should be allowed to acquire necessary foreign exchange for their operations and to remit abroad profits and depreciation on their investment.

Present proved reserves in Colombia were estimated at 543,000,000 bbl., a 14-year supply at present producing rates, but unless new fields are found and developed, the committee said, by 1956 production will drop to little over 101,000 bbl. daily from the 105,800 bbl. daily produced last year. The committee said that exploration should be especially encouraged in the eastern Llanos region where a much greater investment is required due to its inaccessibility.

Pemex Completes Two Wells

Petroleos Mexicanos has completed two wells in a new producing area near Papantla, Veracruz.

The most recent completion was Santa Agueda 5 which was brought in at a depth of 1,100 m., or about 3,630 ft. Pemex sources said the well tested about 7,000 bbl. daily, but no details were given and it was not known whether this rate was with the well completely open.

The other producing well on the structure is Santa Agueda 1. It is anticipated that both wells will be produced at about 4,000 bbl. daily when a pipeline connection to the field is in operation.

The first Santa Agueda well blew out when it hit a high-pressure gas zone. A relief well also blew out and caught fire from gas seeping through shallow, porous rock. Both these holes were eventually plugged.

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Peruvian Tests Hit

Three Lobitos deep wells obtain favorable results

SOME success has been obtained in the development of deep production in Lobitos field in Peru, but efforts to extend El Alto field to the east have been discouraging.

Lobitos Oilfields, Ltd., reported recently that three test wells in Lobitos gave encouraging results. In the northern section, results were favorable in drilling in the Los Organos area.

In the so-called strip area of joint development with International Petroleum Co., Ltd., only a few sites remain to be drilled. It is hoped to maintain production at the present level this year, but a gradual decline must be expected subsequently.

A second joint-development agreement with International covers the so-called A area. Four exploration wells were drilled last year in this section, one of which was a small producer. More recently a promising well has been reported in No. 596, drilled in another sector of the area.

Last year, the company's Peruvian subsidiary, La Cia. Petrolera Lobitos, produced 434,863 tons of crude (about 9,050 bbl. daily), a slight increase over the preceding year. In addition, the company had a half share of the 149,762 tons (about 3,000 bbl. daily) produced in the strip area.

Plant work completed . . . Discussing activities outside Peru, Lobitos Oilfields reported that alterations to the Dubbs cracking unit at its Ellesmere Port refinery in England were completed and a gasoline-sweetening plant erected. The first cargo of Middle East crude was processed last September. In partnership with several other British oil companies, a small investment of about $140,000 was made in western Canada early this year. Lobitos Oilfields also acquired a majority interest in two firms, Redwell Servicing Co., a well-servicing concern, and Big Horn Drilling Co., a drilling and servicing firm.

MIDDLE EAST

Iranian Knot Raveling

Shah's government overtures indicate an early settlement of Anglo-Iranian claims and resumption of oil operations

ALTHOUGH the new Iranian Government avoided committing itself on the oil dispute, there was an increasing feeling last week that the nationalized properties of Anglo-Iranian Oil Co., Ltd., will be back in large-scale operation within a year at most.

The removal of the Mossadegh government was viewed as the first and major step. Next to come will be a resumption of diplomatic relations with Britain. Then new negotiations on terms of a settlement, and if these are successful, rehabilitation of the facilities and arrangement for export shipments.

The desperate plight of the Iranian economy as a result of the 2-year stoppage of oil revenue was made clear by the Shah after his triumphant return to Teheran. He told his people the treasury is empty, and the government faces difficulty in meeting current payrolls.

The new prime minister, Gen. Faxollah Zahedi, met with U. S. Ambassador Henderson. The U. S. Government, anxious to strengthen the new government against the acute Communist menace, was expected to deal sympathetically with Iran's request for emergency financial assistance, though Washington officials said the final decision would be up to President Eisenhower.

Settlement expected . . . General Zahedi announced the government would not extend the offer made 6 months ago by the Mossadegh regime to sell oil at half the world market price to American, Japanese, and Italian buyers. The offer had failed to attract any substantial purchasers.

The interpretation placed on its repudiation was that the new government's policy will be directed more toward an over-all settlement rather than promoting sales in defiance of British legal warnings that they still claim any oil exported in the absence of adequate compensation.

In Teheran, the new prime minister said he was studying the oil question and hoped to be able to sell Iranian oil to the world in a way to gain revenue for Iran. He said the matter of compensation to Anglo-Iranian would have to be settled in a way "compatible with Iranian laws." The Shah said it was much too early to discuss resuming diplomatic relations with Britain.

The new situation in Iran was being closely watched in the industry. Once the dispute is settled on a political level and over-all agreement reached, the industry's problems will just begin. A resumption of Iranian production threatens a cutback in the booming output of Saudi Arabia, Kuwait, and Iraq. It probably will be necessary for the international companies, acting under government direction, to pry open a new position in world markets for Iranian crude or products.

In connection with Iran's plea for emergency aid, there was talk last week of a possible renewal of the United States offer to advance a substantial sum at once with payment in the products now piled up in storage at Abadan.

Wafra Export Set

New pipe line will move oil to sea before 1954

FIRST export of crude oil from the newly discovered Wafra field in the Neutral Zone in the Middle East is expected to take place by the end of the year.

Construction work is now under way on a 35-mile, 8 and 10-in. pipe line extended from the field to an offshore loading point at the northwest corner of the territory.

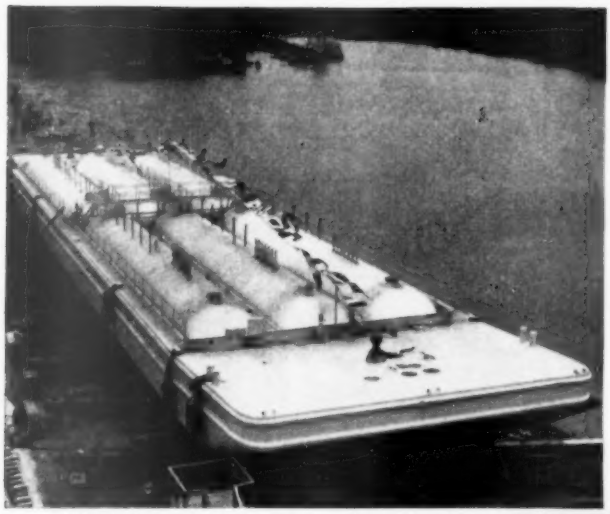
Reports last week were that two loads of the pipe, purchased from Arabian American Oil Co., had arrived and were being strung. Work is moving ahead on the initial two 75,000-bbl. storage tanks at the coastal terminal. Plans call for a 16-in. submarine loading line which will be laid about 2 miles offshore to 55-ft. water depth.

The loading system will be somewhat similar to that at Mena Al Ahmadi in Kuwait. Crude will be gravitated from the tankage into the tanker berth. The 500-ft. elevation of the field also will facilitate movement through the main line.

These facilities are being constructed by American Independent Oil Co., (Aminoil) but it is understood their use also has been offered to Pacific Western Oil Co., the owner of the other undivided half interest in production from the Neutral Zone. These two companies participated in the joint Aminoil-operated drilling program which resulted in the field discovery last spring.

New test under way . . . The one rig operating in the field is now drilling the second well since the discovery. This test, Wafra 6, was reported last

Bethlehem at Beaumont



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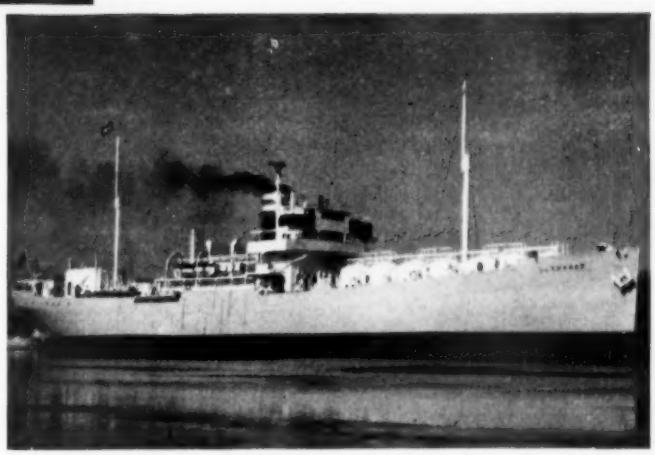

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week coring below 3,500 ft. Potential production from the field is now around 8,000 bbl. daily of 25° gravity crude. Drilling is scheduled to be stepped up at a later date with the purchase of a second drilling rig being arranged with Kuwait Oil Co., Ltd.

The initial shipments of crude from the field are expected to be taken by U. S. companies affiliated with or interested in the concession-holding companies.

FAR EAST

Wildcats in Borneo

Jungle exploration begins in section drilled in 1931

BRITISH MALAYAN PETROLEUM CO., LTD., is carrying out an expanded wildcatting program along with improvements in processing facilities at Seria field in Brunei, British Borneo.

The exploration work is taking place in the Labis area which lies in the jungle between the Belait and Baram rivers about 30 miles directly inland from the present Seria field.

Company engineers have nearly completed a 16-mile road which starts at Bukit Puan, on the bank of the Belait River, and extends inland through the jungle to the sites selected for the two tests. About 14 miles from the river, a swamp was encountered which swallowed thousands of tons of fill for an embankment. A 630-ft. Bailey bridge was then built across this section of the route.

One rig is already in position, and the other location is nearly finished. Still another deep well is located at Bukit Kundol on the bank of the Belait about 10 miles from Labis. Reports indicate that drilling has already commenced at this location.

Between 1912 and 1931, various companies drilled a total of 10 exploratory wells in the Labis area. It is felt that improvements made in exploration drilling practices over the last 20 years justify a new program in the area.

British Malayan is a member of the Royal Dutch-Shell Group. Seria was discovered in 1929, but after the company returned to the area following its recapture from the Japanese, discovery of new and more prolific production allowed output to be built up to the present normal rate of around 103,000 bbl. daily. The field is now the largest in Eastern Asia and has given North Borneo the rank of the major producing area in the British Commonwealth.

The crude varies from 19° to 33° gravity and comes from Tertiary sands ranging from 1,600 to 6,900 ft. in depth. At the beginning of this year, the field had 106 flowing, 36 pumping, and 57 other artificial lift wells. There were six wells drilling, and 86 shut in. Thirty-two other wells, including abandonments and awaiting abandonment, were suspended.

The other North Borneo field, Miri in neighboring Sarawak, is almost negligible in comparison with Seria. It has a production of little over 1,000 bbl. daily from pumping wells which at the beginning of this year numbered 132. The Lutong refinery is located in Sarawak, and the operating company in this area is Sarawak Oilfields, Ltd., also Royal Dutch-Shell.

Work is now under way in Seria on a gas absorption plant costing the equivalent of about $5,500,000 which is expected to be finished in about a year. Associated with this project is a new 35-mile, 4-in. pipe line linking the Lutong refinery with Seria. The line is now being used to move diesel oil for use in the field. When the absorption plant is completed, the line will carry light fractions from the plant to the Lutong refinery for blending.

The Lutong refinery, which handles nearly half of Seria's output, is a distillation plant with a rated capacity of 43,500 bbl. daily. Due to completion of minor modifications, capacity has been raised to 47,000 bbl. daily. Crude intake at the beginning of this year was 42,100 bbl. daily.

Tanker Mark to Fall

Japanese yard is building biggest oil ship in world

A JAPANESE shipyard has started construction on a new record-sized tanker of 45,800 deadweight tons.

The vessel is being built at the Kure yard of the National Bulk Carriers, an American company, for its Liberian-flag operating subsidiary, Universe Tank-Ships, Inc.

Next largest tanker under construction is a 45,400-ton vessel built in Bethlehem Steel Co.'s Quincy, Mass., yard for World Tankers Corp. The American Bureau of Shipping reported five other tankers were ordered at United States and foreign yards during June.

Two 16,500-ton vessels were contracted by Tide Water Associated Oil Co. with Bethlehem Steel's Sparrows Point, Md., yard.

Last month, a 45,000-ton tanker was launched by a German yard for the Olympic Transportation Co. The title of the world's largest tanker has been changing hands steadily in the last few years as the size of the new vessels constantly changed.

Other recent tanker developments:

. . . A 29,500-ton tanker, the Orion Comet, was launched at Bethlehem's Quincy yard for Orion Shipping & Trading Co. The ship has a capacity of 255,000 bbl. and a speed of about 18 knots using a six-bladed propeller.

. . . The first tanker to be built by a French yard for a foreign company was launched at St. Nazaire. The 31,000-ton vessel was constructed for Afran Transports, a subsidiary of Gulf Oil Corp.

. . . The 18,000-ton Hemidonax was launched at Birkenhead in England for Anglo-Saxon Petroleum Co., Ltd. (Shell). When completed the ship will use the new $14,000,000 oil dock at Eastham, Cheshire, built for vessels too large to negotiate the Manchester ship canal to Shell's Stanlow refinery.

International Briefs

West Australia Petroleum, Pty., Ltd., has made location for its first test in the Exmouth Gulf area of West Australia, and drilling was scheduled to begin in mid-August. Ampol was organized by Ampol Petroleum, Ltd., an Australian firm, and Caltex. Caltex, which is furnishing 80 per cent of the capital for the undertaking, is handling the operation through its affiliated American Overseas Exploration, Ltd. The initial test follows surface geological and seismograph work.

Four tankers, scheduled for delivery to Russia, now are under construction at Rauma-Raach Co. shipyard at Rauma, Finland. The first will be delivered next spring. The vessels are being built for Russia under terms of a trade agreement between the two countries. The same shipyard recently delivered two 1,000-ton lighters to Russia and will turn over four more before the end of the year.

Gulf Oil Corp.'s local exploration company in Tunisia has reached a depth of about 7,000 ft. in its second wildcat, the Souinia well, located about 160 km. west of Sfax. The first well about 30 km. north of Sfax failed to find commercial production.

PERSONALS

Operating Executive

Tide Water vice president joined company as foreman

DREW L. HINES has made just about every ascending rung in the ladder of Tide Water Associated Oil Co. in the 31 years since he first joined the firm as construction foreman.

Hines, a vice president of the firm today, was recently named chairman of the eastern division operating committee and head of the company's administrative department. He previously was vice chairman of the operating committee and a member of the company-wide coordinating committee.

Hines has been connected with Tide Water and its predecessor, Associated Oil Co., since 1922 when he joined the firm at San Francisco. Since that time he has been employed as field engineer, district engineer, division engineer, and superintendent of construction in California. He moved on to Seattle as departmental engineer, and then reassigned to the company's engineering department at San Francisco.

After a tour in the Philippines as an engineer for Tide Water, Hines was returned to this country as chief engineer of the pipe-line department and later became assistant manager of the western transportation division.

He moved across the continent to the eastern division in 1944 as manager of the transportation and supply department at New York and became vice president in charge of the department the same year. It was in May 1953 that he became the operating head of the entire company in the East.

Leonard W. Heiny, Salt Lake City, geologist for Continental Oil Co., has been promoted to assistant division geologist with headquarters at Billings, Mont.

William P. White, engineering trainee for Phillips Petroleum Co. in Eureka, Kans., has been transferred to Borger, Tex., as a refining engineer.

Lionel M. Glass has been promoted from driller for Rocky Mountain Drilling Co. in Ventura, Calif., to drilling foreman.

Bruce E. Linkous, engineering trainee for Shell Oil Co. in Bakersfield, Calif., has been transferred to Los Angeles as a junior safety engineer. He has just completed a year's training program.

Orland B. Dommersnaes, production engineer for The Texas Co., has been transferred from Daisetta to Hebbronville, Tex.

Glenn W. King, petroleum engineer for Stanolind Oil & Gas Co., has been transferred from Tulsa to Fort Worth.

Edward E. Smith, Jr., seismic party chief for The Texas Co., has been transferred from Seagraves to Lamesa, Tex.

Robert C. Mill of Esso Standard Oil Co. has been named head of the special studies group, equipment inspection division, in the mechanical department of the Bayway refinery in Linden, N. J.

W. C. Brock has been promoted to chief operator in the Midkiff gasoline plant of El Paso Natural Gas Co. He formerly was assistant plant superintendent. Other El Paso promotions in the Permian division include: **Paul R. Beebe,** formerly chief operator, to plant superintendent at Jal Plant No. 1; **F. W. Sweatt,** formerly a chief maintenance mechanic, to assistant plant superintendent at Jal Plant No. 4; **W. E. Scott,** formerly chief maintenance mechanic at Jal Plant No. 2, to assistant plant superintendent; **Oscar R. Ash,** formerly chief maintenance mechanic, to assistant superintendent at the Goldsmith plant; **Charles G. Smith,** formerly chief maintenance mechanic at Eunice, to assistant plant superintendent; **Wilbur Hayse,** assistant plant superintendent, to chief operator of the Wasson plant; **C. E. Emmerson,** formerly assistant plant superintendent at Dumas, to chief operator; **Donald A. Murphy,** formerly assistant plant superintendent, to chief operator at the Vealmoor plant; and **Cecil L. Sinclair,** formerly a chief maintenance mechanic at Jal Plant No. 3, to assistant plant superintendent.

C. L. McArthur, Jr., formerly manager of the Rocky Mountain region of Lion Oil Co., has been made a special representative of the production and exploration division at Dallas. He was replaced in Denver by **R. I. Williams,** formerly manager of the central region at Wichita, Kans. **E. L. Maxwell** has been named central region manager replacing Williams. Maxwell had been regional geologist of the southwestern region at Midland, Tex.

Jack E. Haughn has joined Kirkpatrick & McGuire, Shreveport consulting engineers. He will assist in making special reservoir studies and in field work. He formerly was with Dowell Incorporated.

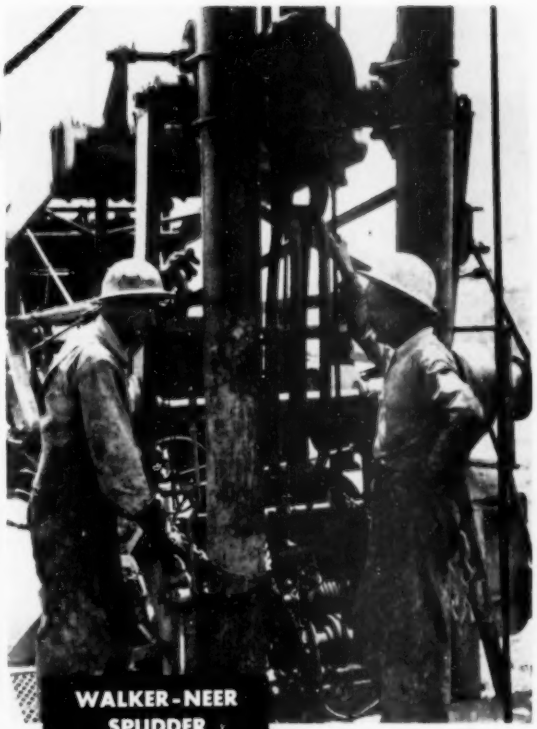
H. H. Wellander has been promoted to assistant superintendent at The Texas Co.'s Wilmington, Calif., refinery.

James W. Nicholas has joined Housh Drilling Co., Houston, and other Housh enterprises, as a production engineer. For the past 5 years he has been drilling and development engineer for Stanolind Oil & Gas Co.'s Gulf Coast division. He was with Stanolind $10\frac{1}{2}$ years and prior to that worked for the Texas Railroad Commission.

John J. Jacob, Jr., will succeed **Edward M. Borger** as president of Peoples Natural Gas Co., September 1. Jacob has served as vice president and as assistant manager of Peoples and New York State Natural Gas Corp., since October 1942 and has been executive vice president of Peoples since January. Borger, who is retiring because of his health, has been president since 1940 and is chairman of the board of directors of New York State Natural and a director of Consolidated Natural Gas Co.

Michael H. Haider, Standard Oil Co. (N. J.), New York, has been appointed to the committee on natural resources of the U. S. Chamber of Commerce. Other representatives of oil and gas industries included on the committee are: **Kenneth C. Heald,** Gulf Oil Corp.,

You Don't Have to Shout!



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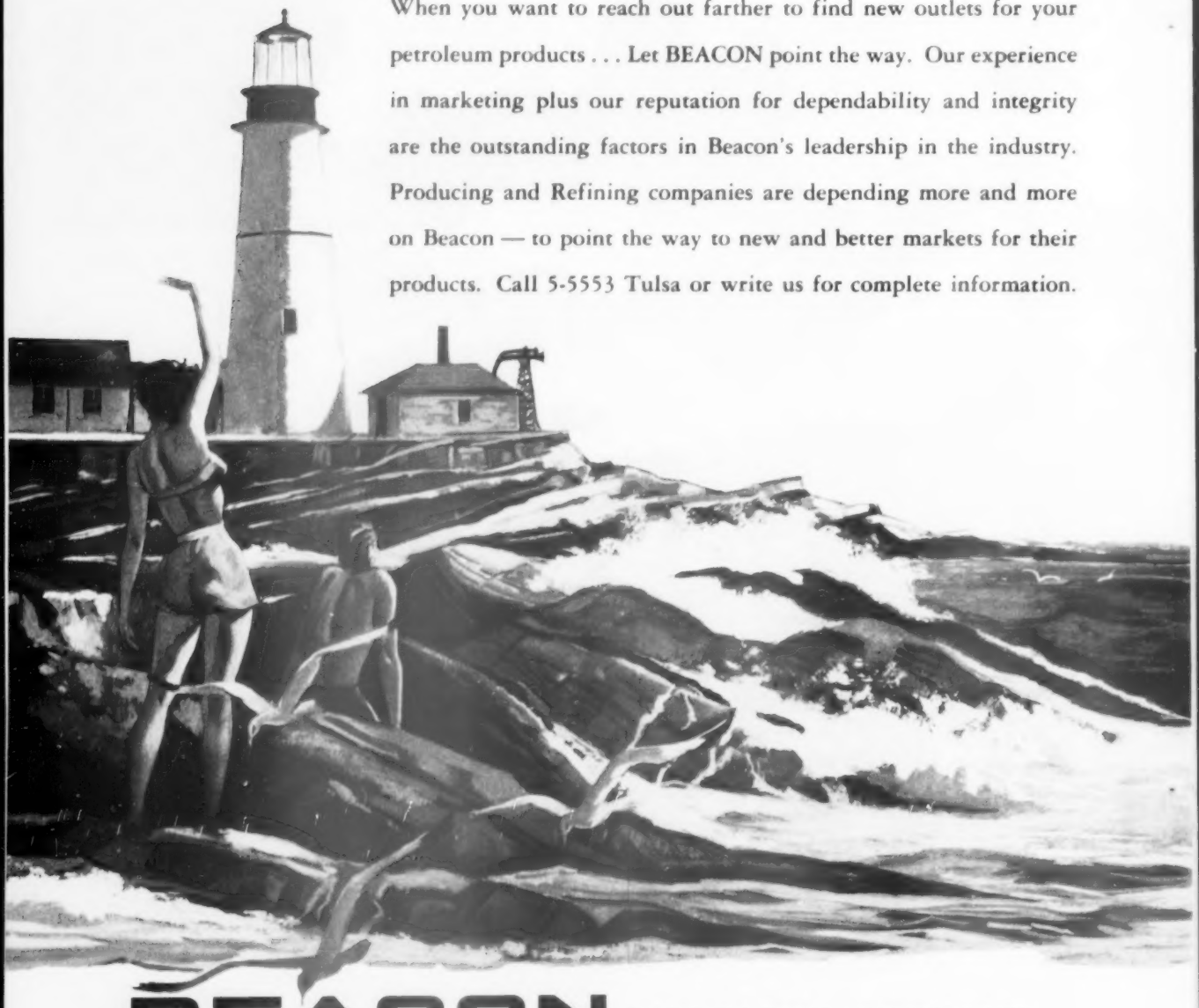

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PERSONALS

Pittsburgh; **J. E. Swearingen,** Standard Oil Co. (Ind.), Chicago; **Walter M. Jeffords, Jr.,** Brooklyn Borough Gas Co., Brooklyn; **C. H. Lyons,** president of Lyons, McCord & Logan, Shreveport; **C. P. Rather,** Southern Natural Gas Co., Birmingham, Ala.; and **C. I. Weaver,** Springfield, Ohio.

M. A. Francis, junior engineer, and **F. F. Fleischer,** chemist, have been transferred by Shell Chemical Corp. from the company's Dominguez, Calif., plant to its new ammonia plant in Ventura, Calif.

H. N. K. Brookings of Shreveport, La., has resigned his position in the geological department of Phillips Petroleum Co., to become an independent consulting geologist. He had been with Phillips at Shreveport for 7½ years.

C. D. ROGERS

Clint D. Rogers, former superintendent of Cities Service Gas Co.'s operations at Wichita, has been named manager of operations at Oklahoma City. **L. C. Benne** has been advanced from assistant superintendent of operations at Wichita to fill Rogers' former post. **H. O. Porter,** former assistant superintendent of gas

L. C. BENNE

H. O. PORTER

transportation, is now assistant superintendent of operations.

Andy Alpha, formerly with U. S. Smelting, Refining & Mining Co. at Billings, Mont., has been named division geologist in Signal Oil & Gas Co.'s new Rocky Mountain region offices in Denver.

Gene Gaddess, formerly manager of exploration in the Williston basin for Union Oil Co. of California, has accepted a position as district geologist for J. M. Huber Corp., at Bismarck, N. D.

North Dakota Oil Men Elect New Officers

Officers elected at the second annual meeting of the North Dakota Oil and Gas Association recently at Bismarck include, left to right, Richard C. Frawley of Sinclair Oil & Gas Co., Bismarck, vice president; W. W. Simpson, Skelly Oil Co., Bismarck, vice president; T. N. (Nick) Jordan, Bismarck, independent, president; William R. Pearce, Bismarck attorney, secretary, and Allan Eastman, Bismarck, executive secretary. Not pictured is Evan Saltzman, president of the First National Bank of Bismarck, treasurer. All but Frawley and Simpson were reelected. (Fargo Forum Photo by Gifford Herron).

Wayne Reed, formerly a petroleum engineer with Delhi Oil Corp., in Casper, Wyo., has joined the staff of the U. S. Geological Survey in Casper.

Manuel Rodriguez Aguilar, former exploration manager for Petroleos Mexicanos, recently left Mexico for Bolivia to join Yacimiento Petroliferos Fiscales Bolivianos, the government oil agency.

Earl Van Vranken, junior petroleum engineer with Ohio Oil Co., at Bay City, Tex., has been promoted to petroleum engineer and transferred to Hobbs, N. M.

John J. Jachym has been named manager of the eastern division of James G. Brown & Associates, Chicago independent producing company.

Earl W. Unruh, who was recently named part-ownership executive of Sinclair Pipe Line Co., has been elected vice president and director of Pioneer Pipe Line Co., which was formed to build and operate the recently completed products line from Sinclair, Wyo., to Salt Lake City.

R. B. Dummett has been named managing director of Commonwealth Oil Refineries, Ltd., refining and distributing company of Anglo-Iranian Oil Co., Ltd., in Australia. He succeeds **K. Washington Gray,** who has 31 years service with Anglo-Iranian and associated companies. Gray will continue to act as a representative of Anglo-Iranian on the boards of Australasian Petroleum Co., Ltd., and Island Exploration Co., Ltd., companies for which he was formerly chief geologist in Papua-New Guinea.

Jack G. Coates has resigned as assistant manager of the crude-oil purchases and sales department of Cities Service Oil Co. to accept a position in the same department of Gulf Oil Corp. at Houston on September 1.

Marvin C. Gentry, formerly district producing superintendent of Magnolia Petroleum Co.'s Healdton, Okla., district, has been transferred to Shreveport as superintendent of the Shreveport district. Other company changes include: **H. V. Harden,** formerly district superintendent at Shreveport, transferred to Healdton as superintendent; **George A. Harmon,** assistant production foreman in the Lea area of the Kermit producing district, promoted to production foreman in the Brownfield district; **D. J. Perryman,** promoted from gang pusher to production foreman in the Luling producing district; **Thomas H. Holbrook,** formerly petroleum engineering assistant in the Duncan, Okla., producing district, named assistant production foreman at Healdton; **Reo Macon Capps,** assistant production foreman in the Chase, Kans., district, promoted to production foreman; **Robert O. Crowder,** petroleum engineering assistant in the Electra producing district, appointed assistant production foreman at Electra; **Ray Neel,** promoted to drilling tools foreman in the West Texas division; and **William C. Moss** and **Travis H. Bryant,** pro-

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PERSONALS

moted from drilling tools foreman to marine drilling tools foreman in the Louisiana-Gulf drilling division at Morgan City, La.

Victor C. Fairless has been appointed general manager of Sun-Canadian Pipe Line Co., Ltd., with offices near Hamilton, Ont. He has been assistant division superintendent of the eastern division of Sun's product-lines department at Coatesville, Pa.

E. R. Shade, formerly staff geologist at the Midland, Tex., district office of Ohio Oil Co., has been promoted to district geologist at San Antonio.

Don Agnew, formerly Gulf-Southwestern director of the American Petroleum Institute's Oil Industry Information Committee, has been named Gulf Coast regional manager for Universal Petroleum Co., Houston.

JAMES K. SMALL

James K. Small has been promoted from associate manager to manager of the patent division of Standard Oil Development Co., Elizabeth, N. J. Formerly a research chemist at Baton Rouge, he joined S.O.D.'s patent division in 1930. As divisional manager, he succeeds **Philip L. Young,** who has been appointed secretary of the company with offices in New York.

Standard Oil Co. (Ind.), has named four assistant division directors—new positions in the Whiting, Ind., research laboratories. They are **A. P. Lien,** chemical products division; **G. M. Webb,** hydrocarbon research division; **A. W. Lindert,** heavy-oil-products division, and **J. F. Snuggs,** process division. Other promotions in hydrocarbon research include **C. E. Johnson** and **H. S. Seelig** to section leaders and **W. A. Wilson** to group leader. **W. C. Edmisten** has been advanced to group leader in heavy-oil products, and **J. A. Bock** has been named section leader and **Joseph Gurawitz** group leader in the process division.

Walter L. McCloy has been transferred from Oklahoma City to Billings, Mont., as division superintendent of operations in the Rocky Mountain region for Sohio Petroleum Co.

D. S. Turner, formerly with Petroleum Research, Denver, has joined Wm. R. Whittaker Co., Ltd., as a geogist at Denver.

D. D. Freeborn, former Oklahoma City district manager of Mid-Continent Petroleum Corp., has been transferred to Tulsa as assistant division manager. He succeeds **E. E. Marsau,** who has been named manager of the Terre Haute, Ind., office. **L. D. Sullivan** succeeds Freeborn at Oklahoma City. **J. R. Stockton,** buyer for refinery requirements, is retiring after 28 years with Mid-Continent Petroleum Corp., and is being succeeded in Tulsa by **C. R. Roberts.**

W. D. Lane, district superintendent for Plymouth Oil Co., at Midland, Tex., has been named president for the 1954 Permian basin oil show to be held at Odessa, Tex. Other officers are: **Roy E. Carter,** field manager of the Carter Foundation Production Co., at Kermit, Tex., first vice president; **Joe T. Dickerson,** Shell Oil Co., Midland, Tex., second vice president, and **Carlos Clover,** public accountant at Odessa, secretary-treasurer.

Billy Easley has been named chief geologist and **Landon Curry** assistant chief geologist for Heep Oil Corp. Easley formerly was South Texas district geologist and Curry was assistant district geologist for Sunray Oil Corp. Both will remain in Corpus Christi.

P. C. Heinsohn has been named area manager for Sinclair Refining Co., and replaces **F. J. Felice,** who has been promoted to assistant western district manager at Kansas City. Heinsohn has been located at Pasadena, Tex.

DEATHS

H. R. Bennett, 57, vice president and director of Union Producing Co. since 1946 and director of United Gas Pipe Line Co. since 1947, died August 19 at Shreveport. Bennett entered the oil industry in 1921 as an independent operator in Houston and was an executive with Mills Production Co., of Houston, for several years before joining Union Producing Co.

Marcel Schlumberger, 69-year-old cofounder of Schlumberger Well Surveying Corp., died August 19 in France. A civil engineer, he served as special adviser to various French enterprises for several years before joining his brother, Conrad, in 1919 to develop electrical-prospecting techniques. Electrical logging of oil wells was the outgrowth of their work and in 1941 they were awarded the Anthony L. Lucas gold medal by the American Institute of Mining and Metallurgical Engineers. Schlumberger became president of the corporation after his brother's death in 1936. He was succeeded by his son, Pierre, as president in 1946.

George Finlay, 68, marine superintendent with Imperial Oil, Ltd., for 32 years, died recently at Sarnia, Ont.

R. E. Shackelford, 47, general manager of Perrault Equipment Co., died August 25 in Tulsa following a stroke the day before. Shackelford had been in a mangerial position with Perrault for 8 years.

D. W. Henke, 65-year-old president of Merla Tool Corp., died recently while vacationing in Portage, Wis. Henke, an independent operator and manufacturer of oil-field equipment for 35 years, was an officer and director of Guiberson Corp., before forming Merla Tool Corp. in 1936.

Dr. Frederick E. Wright, 75, died August 25 at his summer home in the Thousand Islands. He was former home secretary of the National Academy of Sciences and retired petrologist with the geophysical laboratory of the Carnegie Institute of Technology.

Leon David Horn, 26, rigger for Humble Oil & Refining Co., was killed in an automobile accident near Anahuac, Tex., August 22.

Frank C. Fogarty, an independent oil operator and former executive secretary of the Rocky Mountain Oil and Gas Association, died August 19 in Denver. He was a pioneer in Wyoming and Colorado oil activities.

G. A. Gamble, founder and president of Woodbine Oil Corp., died in Dallas August 19. He was born in Denton, Tex., and had been a resident of Dallas for the last 40 years.

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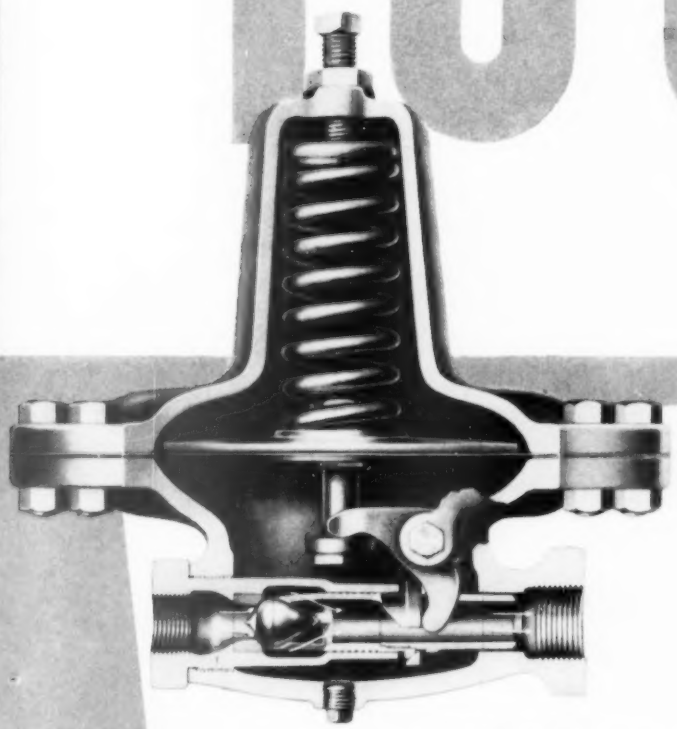

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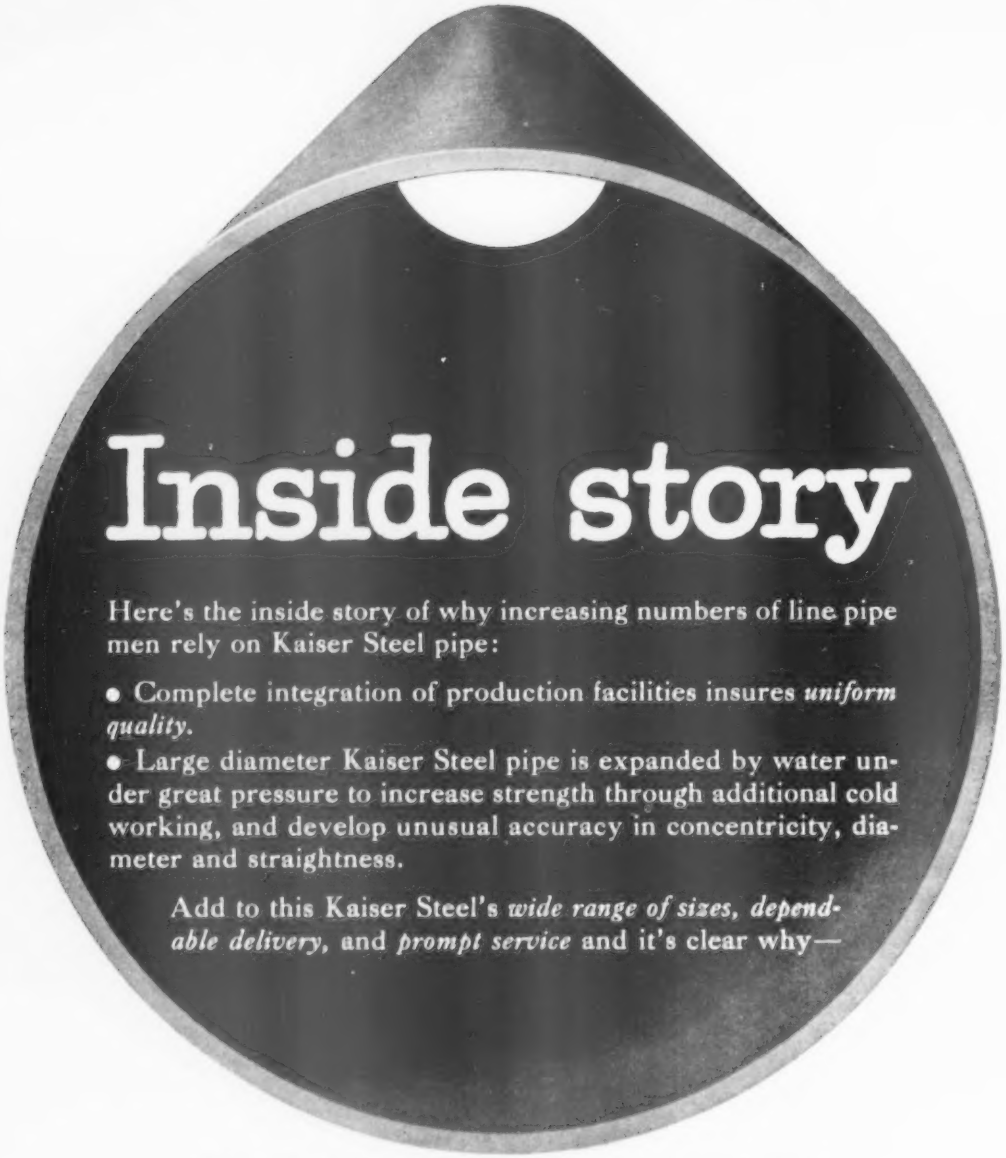

Inside story

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Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

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ROCKY MOUNTAIN OIL

A SPECIAL SECTION OF THE OIL AND GAS JOURNAL

THE ROCKY MOUNTAINS . . .

A Beckoning Frontier

for the American oil industry

THE intermontane basins of the Rocky Mountains and those basins of the Great Plains immediately to the east of the Rockies offer the greatest undeveloped oil country in the United States.

This tremendous province has been barely scratched even though it has produced oil since shortly after the 1859 discovery in Pennsylvania and has borne some of the largest oil fields in the United States. The Rocky Mountain region includes nearly one-quarter of the estimated volume of sedimentary rocks above 20,000 ft. of burial in oil-producing states but currently yields less than 6 per cent of the total crude-oil production of this country.

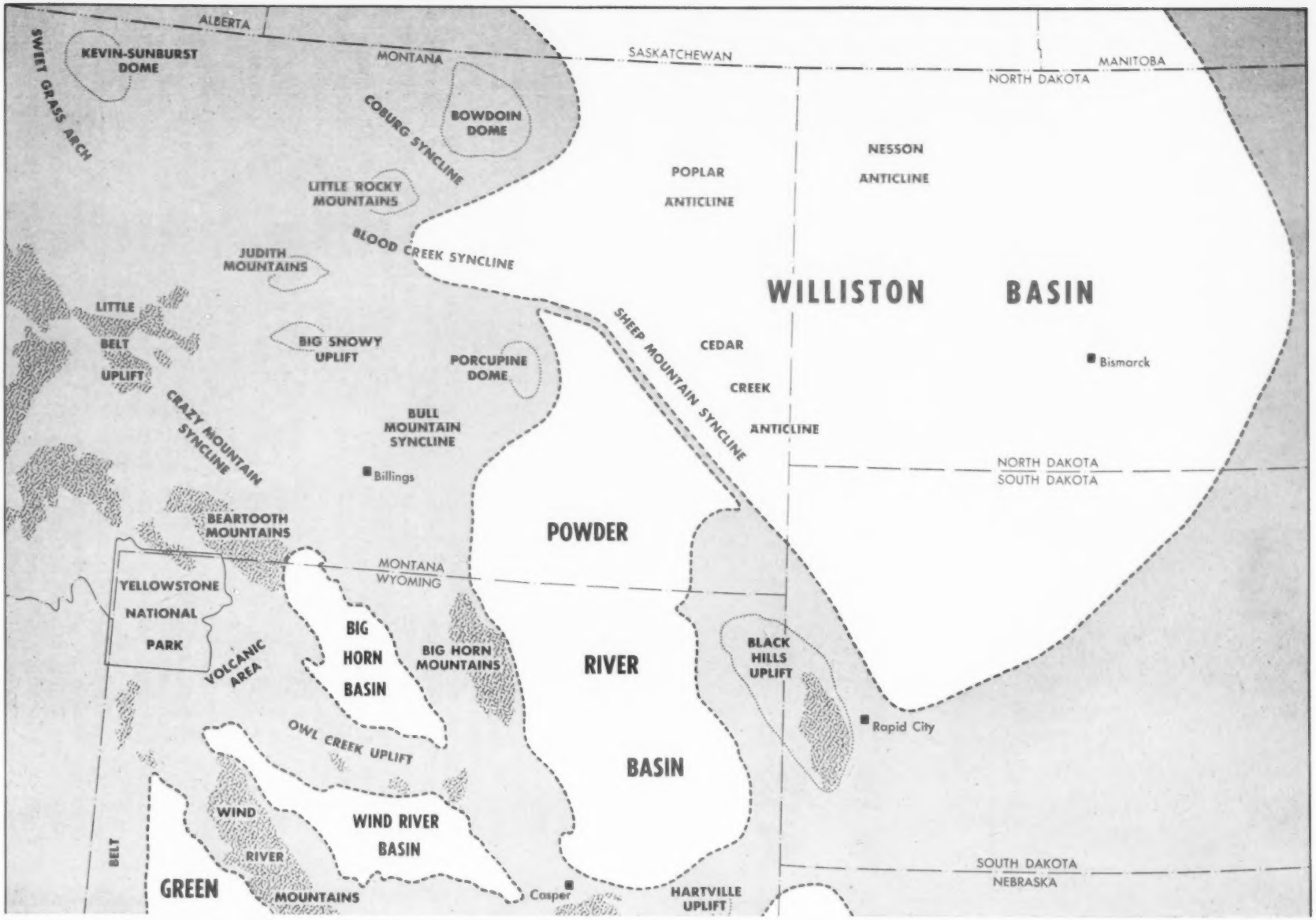
Only in recent years have exploratory efforts in the Rockies graduated from the testing of the crests of prominent, surface-expressed anticlines to an approach which includes all of the known tools of the geologist. Today exploration men are pouring into the Rocky mountain area. They are coming without preconceived ideas of where Rocky Mountain oil is supposed to be found. They are bringing in experience from other areas that is applicable but untried in the Rockies. The new fields in the Williston basin and on the east flank of the Julesburg basin, the fields in fractured Tertiary rocks in the Uinta basin and the fields in facies traps of several intermontane basins are convincing examples of the success of relatively new exploratory thinking in the structure-rich Rocky Mountain area.

This special section of The Oil and Gas Journal is devoted to eight prominent Rocky Mountain basins. It is designed to give the reader a concise picture of each of these basins —its location, geology, important oil fields, current activity, drilling and production practices, outlets for oil and gas, and refineries.

The eight basins are:

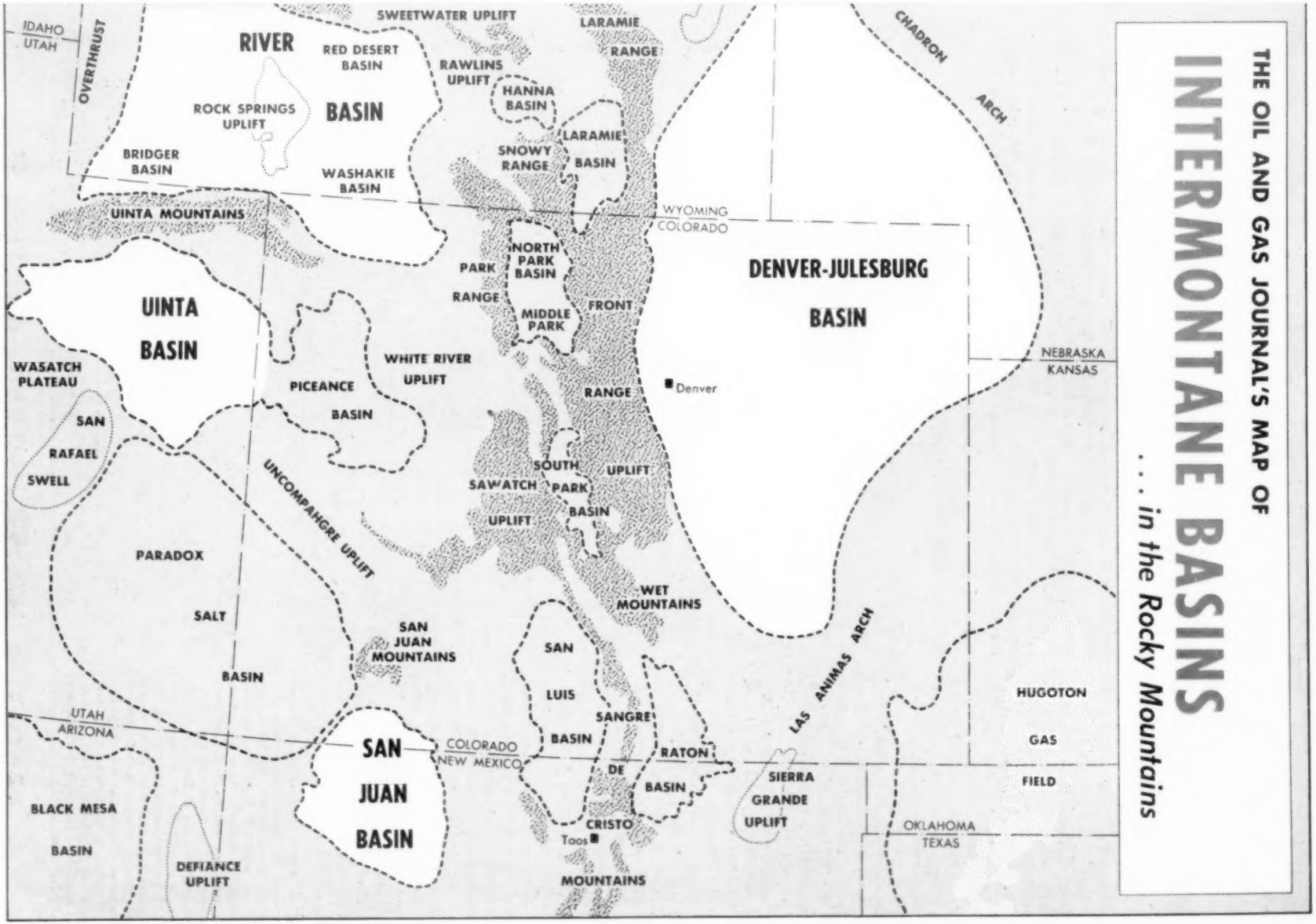
1. WILLISTON, the newest producing basin in the Rocky Mountain area Page 72
2. BIG HORN, the biggest oil-producing basin in the Rockies Page 81
3. WIND RIVER, a geologically complex producing basin of Central Wyoming Page 86
4. POWDER RIVER, Wyoming's most active oil-producing basin Page 91
5. DENVER-JULESBURG, the busiest basin in the Rocky Mountain area Page 95
6. GREEN RIVER, Wyoming's most promising basin for big gas reserves Page 100
7. UINTA, the newest intermontane basin in the Rocky Mountains Page 108
8. SAN JUAN, the greatest gas-producing basin in the Rockies Page 113

. . . Here Is the Nation's Greatest Undeveloped Oil Country



THE OIL AND GAS JOURNAL'S MAP OF INTERMONTANE BASINS

. . . in the Rocky Mountains



(White areas indicate the eight most prominent basins. These are fully discussed on following pages.)

WILLISTON . . .

Newest Producing Basin of the Rockies

OIL in commercial quantities was not discovered within acceptable limits of the Williston basin until 1951, making this sedimentary unit the newest of the oil-producing basins of the Rocky Mountain province.

The Williston basin is also the biggest single unit under Rocky Mountain jurisdiction. Including the Canadian portion, there are 120,000 sq. miles within the basin's somewhat arbitrary boundaries.

The discovery of oil in North Dakota in April 1951 marked the first production for the United States portion of the Williston basin. A few months previously a small oil well had been completed on the edge of the basin in southwestern Manitoba. Within a few months after the completion of the North Dakota discovery, oil was found in the Montana portion of the Williston basin and a frantic rush for leases throughout the area resulted.

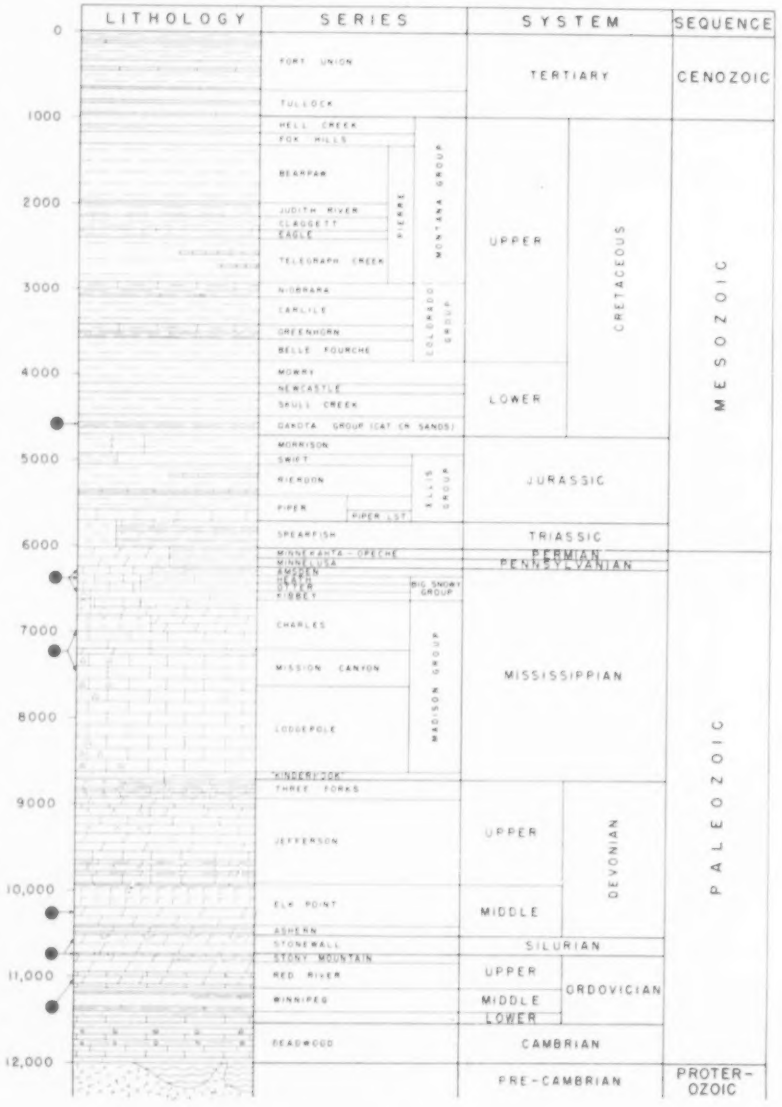
Today, only a little more than 2 years after the initial discovery in North Dakota, the United States portion of the Williston basin is producing nearly 20,000 bbl. of oil daily from six fields in North Dakota and six in Montana; leasing activity has become rather normal for an oil-producing province; and geophysical exploration, which has been at record levels during the past 2 years, has reached a point that scientific wildcatting is on the upswing. Wildcats, hurriedly located to evaluate acreage, without the benefit of detailed geological and geophysical work, are on their way out.

The Williston basin is currently faced with the problem that hits all new producing areas: how can sufficient producing capacity be developed to attract pipe lines and refineries without having those marketing facilities to attract operators from areas where oil is still plentiful and marketing facilities in existence? (See discussion on the current marketing situation in the Williston basin, beginning on page 79.)

Geologic Sketch

The Williston basin is located in North Dakota, eastern Montana, the northwestern portion of South Dakota,

Generalized Stratigraphic Section, Williston Basin

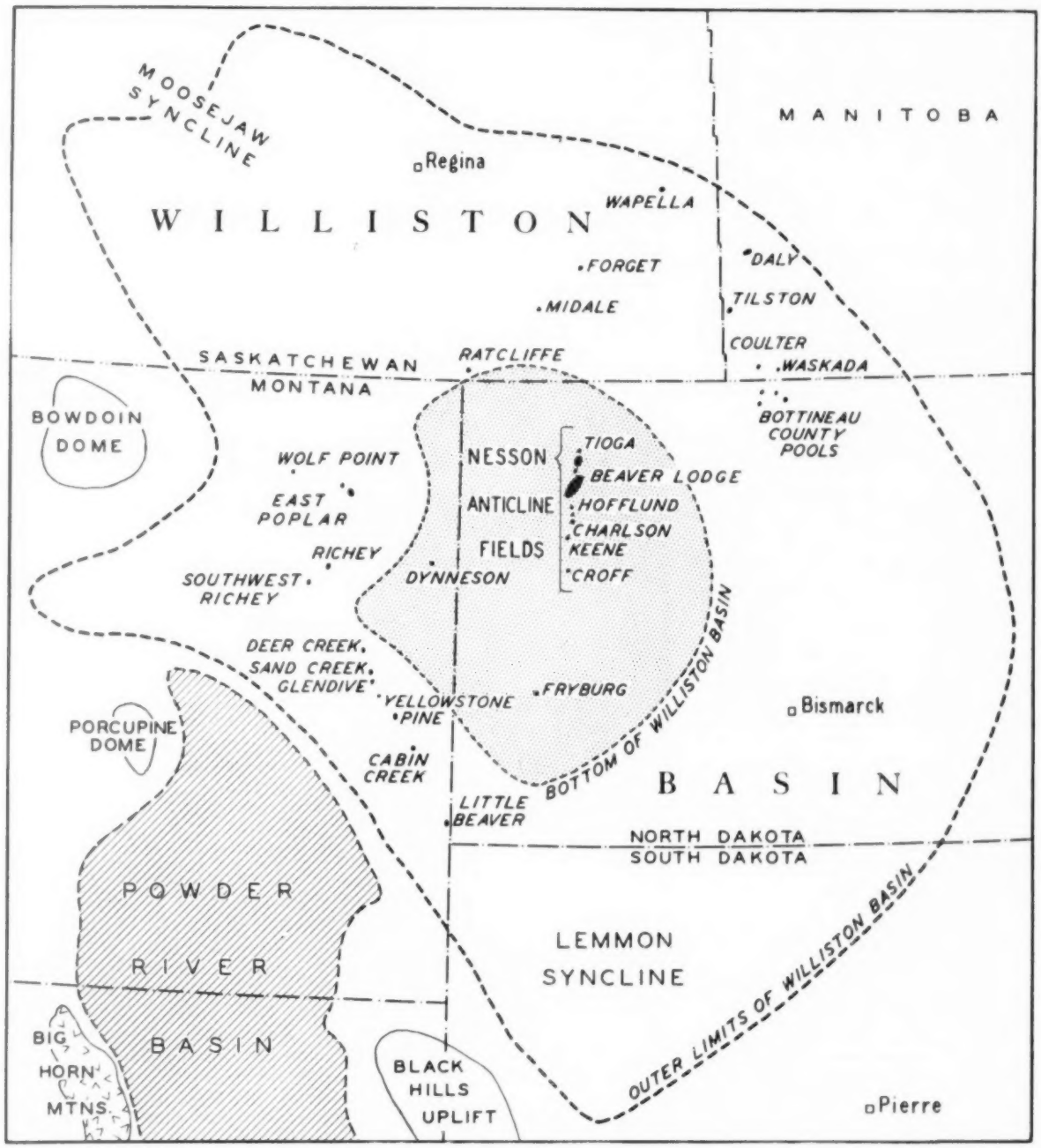


WILLISTON BASIN formational sequences are shown on this generalized stratigraphic section which shows graphic and tabular relationships of sediments from the pre-Cambrian through the Tertiary. While this section was prepared from sample studies of wells taken along the Cedar Creek anticline of the eastern Montana portion of the basin, it may be applied to stratigraphy in western North Dakota and northern South Dakota with but few modifications. Large solid circles shown at left of graphic column indicate current proved or assured producing reservoirs. Dakota circle refers to production lying west of the limits of the Williston basin as considered in this article. (Courtesy T. R. Barnes, Shell Oil Co., Billings, Mont.)

and extends into Canada. It ticks the southwestern corner of Manitoba and includes most of southern Saskatchewan.

Though considered a Rocky Mountains basin, Williston lies wholly within the Great Plains physiographic province. It has no obvious limiting features such as characterize the intermontane basins of the Rockies, except for the relatively small Black Hills and the Bowdoin dome.

A rather generally accepted outline for the Williston basin is as follows: On the northeast the basin is limited by the feather edge of the Mississippian rocks as they wedgeout toward the Canadian shield. On the east and south the basin outline conforms rather closely to the zero contour on the Dakota sandstone. The outline skirts the Black Hills and takes in the Sheep Mountain and Blood Creek synclines of eastern Montana. It swings eastward around the Bowdoin dome. Up in Saskatchewan there is no definite geologic or topographic break between the Williston basin and the southern portion of the Alberta homocline. Here the Williston basin outline includes the southern portion of the southeastward-plunging Moosejaw syncline and then swings southeastward to tie in with the approximate limit of the Mississippian wedgeout in Manitoba. Thus limited, the Williston basin includes 80,000 sq.



miles of territory in the United States and 40,000 sq. miles in Canada.

Though there are slight surface expressions of deep-seated structures within the basin area, only three are of regional significance. They are the Nesson anticline of North Dakota and the Poplar and Cedar Creek (Baker-Glendive) anticlines of eastern Montana.

Stratigraphy

There is a rather complete section of Paleozoic and Mesozoic rocks in the Williston basin. The Mesozoic rocks are primarily clastics and the Paleozoic rocks are primarily carbonates. Evaporites are found in the basal portion of the Mesozoic section and the Mississippian and Ordovician. The deepest portion of the basin is in the northwest corner of North Dakota where a sedimentary section up to 15,000 ft. is believed to be present.

Due to the lack of adequate subsurface control and the distance between outcrops of pre-Cretaceous rocks, acceptable correlations within the Williston basin have been a subject of considerable discussion during the past 2 years. Recently the Williston Basin Correlation Committee of the American Association of Petroleum Geologists has adopted a preliminary nomenclature chart for the Williston basin.

In a series of electric-log cross-sections published by the North Dakota Geological Society, the following formation descriptions which, in general, are those adopted by the A.A.P.G., were used as the simplest criteria for making electric-log picks at present:

Cretaceous . . . In north-central Montana alternating shales, sandstones, and sandy shales of the Montana group are subdivided into Bearpaw, Claggett, Eagle, and Telegraph Creek. The succession thins eastward, and shales up until in northwestern North Dakota it cannot be subdivided and is here known as the Pierre shale.

The Colorado group is subdivided into the Niobrara-Carlile, Greenhorn, Belle Fourche-Mowry, Muddy or Newcastle lenticular sandy zone, and Skull Creek. The succession thins eastward from north-central Montana to northeastern North Dakota. For regional purposes, the beds between the Skull Creek and the Jurassic are grouped under the name Cloverly. For purposes of local subdivision, the names Cat Creek and Kootenai, and Dakota, Fuson, and Lakota are recognized.

Jurassic . . . The Jurassic is divided into three formations. The Morrison formation of Upper Jurassic age is a shaly nonmarine unit below the Cloverly sandstones and above the Sundance formation. The Sundance, also Upper Jurassic, contain marine sandstones and shales with limestone near the base. Its top is picked at the highest sandstone or the top of correlative green shales. The underlying Piper formation of Lower Jurassic age consists of varicolored shales and gypsum at the base, marine shale, and a persistant limestone bed at the top. The Piper overlies Triassic or Permian rocks, and, with the Sundance, constitutes the Ellis group.

Triassic and Permo-Pennsylvanian . . . Salt beds are present in the Triassic along the Nesson Anticline. The Permo-Pennsylvanian may extend further north and east than now shown but no faunal evidence exists to confirm this at present. The Permian beds, Minnekahta and Opeche, show a distinct pattern on the electric log, and pinch out northward a short distance from the center of the basin. The Minnelusa and Pennsylvanian age shows a broken section on the electric log. These beds also pinch out northward. The underlying Amsden has tentatively been placed in the Pennsylvanian, but it is recognized that Mississippian fauna have been identified in the lower portion.

Mississippian . . . Uppermost Mississippian sediments, predominately shale, underlie the Permo-Pennsylvanian dolomites. Below these lie the Charles evaporites and carbonates. The underlying Mission Canyon formation is predominantly limestone. Below this formation is the Lodgepole, the top of which is placed on a tight argillaceous limestone section. The lowest Mississippian, the Bakken, is called at the first good shale break and is composed of shales, siltstones, and limestone.

Devonian . . . Best development of the Devonian in the area occurs in north-central and northwestern North Dakota and southwestern Manitoba.

A marked thinning in southwestern, southeastern, and southerly directions from these areas is shown. Deep Rock Oil Corp.-Stanolind Oil & Gas Co. 1 Brusich in Slope County, North Dakota, shows a relatively thin Devonian section, difficult of positive correlation. Southwest of this well, Shell Oil Co. 1 Little Beaver and Pure Oil Co. 1 Cox on the south end of the Cedar Creek anticline probably have no Devonian. The few wells in north-central South Dakota have thin typical Devonian sections, presently indivisible.

BEAVER LODGE FIELD discovery completed in April 1951 proved the Nesson anticline in North Dakota oil-productive.

Silurian . . . The Silurian system in the Williston basin is characterized by a series of pastel to white dolomites and dolomitic limestones, the porosities of which vary from none at all to the excellent large vugular type. Due to the lack of adequate subsurface control, the separation of this system into its three component units as seen on outcrop has not been achieved.

The Silurian top has been picked on electric logs and radioactivity logs where the lithology changes from the argillaceous material of the overlying Ashern of Devonian age to the more dense dolomites of the Silurian.

Ordovician . . . The top of the Ordovician is placed at a sandy red shale defining the top of the upper Stony Mountain in the eastern portion of the basin. Westward, a few disseminated sand grains may be the only marker. The lower Stony Mountain is usually characterized by a white and gray shaly fragmental limestone. The underlying Red River formation is predominantly carbonate and at its base the Winnipeg formation shales and sands are distinctive. West to east, the Winnipeg lies on Cambro-Ordovician, Cambrian, and pre-Cambrian.

Producing formations . . . To date commercial production in the Williston has been proved or assured in the Mississippian-Madison, the Devonian, Silurian, and Ordovician rocks. Small gas wells in the Judith River and Eagle formations of Cretaceous age have been produced on the Cedar Creek anticline since 1914. In the Saskatchewan portion of the basin there is one producing area where oil is found in sands of Cretaceous and Jurassic age.

Significant Fields

(See accompanying table)

The oil fields of the Williston basin are restricted to the three previously mentioned, prominent, surface-expressed anticlines with a few notable exceptions. The biggest producing area is on the Nesson anticline of North Dakota.

Nesson anticline fields . . . The first commercial production of oil in the United States portion of the Williston basin was on the Nesson anticline. Though the initial discovery was high-gas-oil-ratio oil from the Silurian at about 11,600 ft., development of Nesson anticline fields is currently restricted to the Mississippian-Madison at 8,000 to 9,000 ft.

The biggest field on the Nesson anticline is Beaver Lodge. The next biggest, which almost joins Beaver Lodge on the north, is Tioga. Strung out along the Nesson anticline to the south of these two big fields are five few-well pools, all of which produce from the Madison. The distance between the southernmost and northernmost pro-

Drilling and Production Data, Williston Basin

Field and county—Producing name and formation age—	Year disc.	Type Str.*	Pay depth	Grav. oil, °A.P.I.	Wells: Flowing	Wells: Pumping	Wells: Total	Wells: Drlg.	Acres proved devel.	Oil production: B/D	Oil production: Cum. 7-1-53
NORTH DAKOTA, OIL:											
Beaver Lodge, Williams—Mission Canyon—Mississippian limestone	4-51	A	8,520	42.5			104	9		8,230	2,892,000
Charlson, McKenzie—Mission Canyon—Mississippian limestone	8-52	A	8,914	42.5			3	1	120	128	25,900
Charlson South, McKenzie—Mission Canyon—Mississippian limestone	2-53	A	9,066	42.5			1	0	40	30	4,100
Croff, McKenzie—Mission Canyon—Mississippian limestone	5-52	A	9,515	42.5			1	0	40	38	17,900
Fryburg, Billings—Mission Canyon—Mississippian limestone	7-53	A	9,403	41.1				1	40		
Hofflund, Williams—Mission Canyon—Mississippian limestone	10-52	A	8,674	42.5			2	0	80	123	22,400
Tioga, Williams, Mountrail, Burke—Mission Canyon—Mississippian limestone	9-51	A	8,312	42.5			74	8		5,480	1,357,000
Tioga East, Mountrail—Mission Canyon—Mississippian limestone	1-53	A	8,276	42.5			1	1	40	41	4,300
MONTANA, OIL:											
Brorson (Dynneson), Richland—Red River—Ordovician limestone	6-53	A	12,585	46.3	1	0	1	0	40	100	
Cabin Creek, Fallon—Red River—Ordovician limestone	5-53	Af	8,688	32.7	1	0	1	0	40	200	5,188
Deer Creek, Dawson—Red River—Ordovician limestone	8-52	Af	9,200	41.0	2	2	4	2	160	605	99,836
Duck Creek, McCone—Jefferson—Devonian limestone	1953	Af	10,188		1	0	1	0	40		
Glendive, Dawson—Red River—Ordovician limestone, dolomite, anhydrite	12-51	Str	9,908	40.0	7	0	7	2	400	1,446	427,914
Little Beaver, Fallon—Red River—Ordovician dolomite	7-52	A	8,313	31.0	0	3	3	0	120	259	58,374
Pine Unit, Wibaux—Red River—Ordovician dolomite	1952	A	8,940	33.0	4	2	6	1	200	671	170,304
Poplar East, Roosevelt—Madison—Mississippian limestone	3-52	A	5,648	40.6	20	1	21	2	16,000	2,409	791,729
Poplar North (Ajax), Roosevelt—Madison—Mississippian limestone	10-52	Str	6,040	40.0	0	1	1	2	40		
Richey, Dawson—Charles—Mississippian dolomite	11-51	A	7,183	38.0	7	3	10	0	360	595	247,502
Richey Southwest, McCone—Jefferson—Devonian dolomite	1952	A	9,090	49.6	2	1	3	1	80	239	47,438
Richey West, McCone — Mission Canyon—Mississippian dolomite	1953	A	7,506		1	0	1	0	40		
Sand Creek, Dawson—Red River—Ordovician dolomite	10-52	A	9,447	31.5	1	0	1	0	40		
Wolf Point North, Roosevelt—Mission Canyon—Mississippian dolomite	1952	Str	6,400		0	1	1	0	40	32	
Woodrow, Dawson — Charles — Mississippian dolomite	8-52	A	7,200	32.0	1	0	1	1	40		3,180
Yellowstone, Dawson—Red River—Ordovician dolomite	7-53	A	8,735	34.3	1	0	1	1	40		

*Legend: A—anticline; Af—faulted anticline; T—terrace; L—lenticular; Str—stratigraphic; M—monocline.

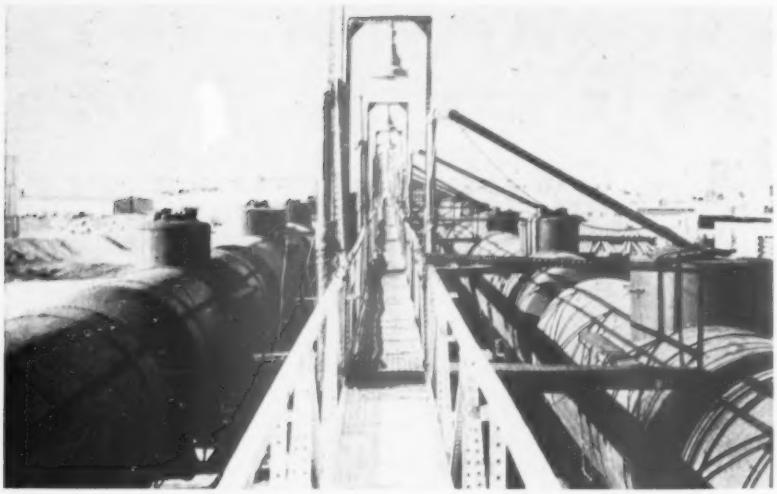
ducing wells on the Nesson anticline is about 60 miles. There is a lone Madison producer about 3 miles east of Tioga field and single Madison producers to the north and south of Tioga field about 1 mile. The eventual outcome of the nonproductive area between these outposts is not predictable at this time.

Poplar anticline fields . . . There are currently three producing areas in the Poplar area. The most important is the East Poplar unit which is being developed in the Madison. Wells in this unit initial 250 to 2,000 bbl. of oil daily. In a syncline northwest of the unit is North Poplar, a two-well pool which also produces from the Madison. Just outside the East Poplar unit to the northeast, a recent discovery found oil in the Madison considerably lower than where it is productive at East Poplar indicating that this discovery has probably opened a new pool.

Richey area . . . Between the Poplar and Cedar Creek anticlines are two productive areas, Richey and Southwest Richey. Here production is from the Madison (Charles and Mission Canyon) at Richey and the Devonian, or possibly Silurian, at Southwest Richey.

Several dry holes have been completed in the Richey area and most of the completed wells produce considerable water along with their oil. It was the comparatively poor results of Richey's initial development that resulted in the idea that perhaps big oil in the Williston basin was restricted to the major structural features.

Cedar Creek anticline . . . Oil pools are strung out along the Cedar Creek anticline for a distance of nearly 100 miles. There are seven producing areas on this northwest-southeast trending structure. They are, from north to south: Deer Creek, Sand Creek, Glendive or Cedar Creek, Yellowstone,



LOADING RACK at Tioga, N. D., moves oil from Nesson anticline oil fields to Middle West refineries.

Pine, Cabin Creek, and Little Beaver.

All of these fields produce from pre-Mississippian rocks. Deer Creek, Yellowstone, Cabin Creek, and Little Beaver produce from the Ordovician. Sand Creek, Glendive, and Pine produce from a Siluro-Ordovician section. There is some Siluro-Devonian production at Pine and Cabin Creek is assured of Silurian production, now behind the pipe. In the Woodrow area, between Deer Creek and Sand Creek, there is a shut-in well which swabbed oil from Mississippian rocks.

Development has not advanced very far at any of these fields on the Cedar Creek anticline, but because of the multiplicity of pay zones indicated or assured by the various discoveries great promise appears in store for this long, narrow structure. What appears to be the best well in the Williston basin to date was found at Cabin Creek. This discovery was completed in 168 ft. of effective Ordovician between 8,688 and 8,957 ft. for 244 bbl. of oil daily. It flowed at rates of more than 2,000 bbl. daily on production tests of the Silurian at 8,267-8,535 ft.

Fryburg . . . The most recent indicated discovery in the Williston basin is Amerada Petroleum Corp. 1 May in Billings County. This well, located 60 miles south of the southernmost producing field on the Nesson anticline and about the same distance east of production on the Cedar Creek anticline, is on an isolated seismic structure. On a drill-stem test near the top of the Madison the 1 May flowed 392 bbl. of 40° gravity oil through a ⅜-in. choke on a 24-hour gage. This assured discovery calls for an increasingly skeptical attitude toward the idea that perhaps truly big oil accumulations in the Williston basin are restricted to the regional structures.

Dynneson . . . Another wildcat not on a major structure is being tested by Sun Oil Co. and Phillips Petroleum Co. This possible discovery has flowed oil at rates up to 200 bbl. daily from the Ordovician at 12,600 ft., but is currently plagued with water encroachment.

Bottineau County . . . Just south of that area in Manitoba where the first oil discovery in the Williston basin was completed is Bottineau County, North Dakota. Within this county several small producing wells have been developed in the Mississippian or near the contact of the basal Mesozoic formation and Mississippian. The ultimate significance of this development is still in doubt as most of the wells are of questionable commercial caliber. Two official completions have been made. One discovery reported 90 bbl. of fluid per day, 30 per cent water, on pump, and the other 30 bbl. of oil daily, 2 days per week.

South Dakota . . . There is still no oil production in South Dakota, but two wells have found free oil in the Ordovician-Red River. Carter Oil Co. recovered a little free oil in the Red River at a wildcat in the northwest corner of the state. Because of mechanical difficulties, this wildcat was plugged and another hole started 100 ft. away. About 100 miles to the southeast, in Dewey County, Kerr-McGee Oil Industries, Inc., recovered about 10 ft. of free oil on a drill-stem test of the Red River.

Manitoba . . . There have been four Mississippian discoveries in Manitoba, all in the southwesternmost corner of the province. The only discovery that has had any significant development is Daly field where there are now about 40 wells producing about 30,000 bbl. monthly.

Saskatchewan . . . There have been three Mississippian discoveries and a Jurassic-Cretaceous discovery in Saskatchewan. The Jurassic-Cretaceous discovery, Wapella, has seen the most development. There are about 15 wells in this field.

Geophysical activity . . . At midyear 1953, 45 seismic crews were working throughout the Williston basin. Of this total 29 were active in North Dakota areas, 6 in South Dakota, and 10 in eastern Montana. In addition there were six gravimeter crews operating in North Dakota.

Seismic work in North Dakota portion of Williston rose 257 per cent for 1952 over 1951. During 1952, 436 crew-months of seismic work were expended throughout North Dakota; bulk of this work was centered on the Nesson anticline although important seismic studies were made along the eastern and northeastern flanks of the basin.

Gravimeter work during 1952 rose in North Dakota to 43 crew-months as compared with 39 crew-months for 1951. Principal work was conducted for Gulf Oil Corp., Pegasus Division of Socony-Vacuum Oil Co., Inc., and Sunray Oil Corp.

Drilling activity . . . A total of 103 drilling rigs are active throughout Williston, which comprises one of the principal drilling campaigns in the nation. This work is almost evenly divided between exploratory and development. Rigs are strung out throughout North Dakota, eastern Montana, South Dakota, and the prairie provinces of Manitoba and Saskatchewan in the Great Northern Plains of western Canada.

Exploratory drilling . . . As of July 18, 1953, there were 52 exploratory drilling rigs active in the Williston basin. In eastern Montana alone, there were 14 rigs active in Carter, Daniels, Dawson, Fallon, McCone, Richland, Roose-

velt, Sheridan, and Wibaux counties. In a single county, McCone, five rigs are active in exploratory work.

In North Dakota, there are 11 active exploratory rigs. Along the Nesson anticline, seven of these are concentrated in Burke, McKenzie, and Williams counties. Remainder are working in Barnes, Billings, Bottineau, Divide, Foster, McHenry, and Stark counties principally in seismic prospects. Bottineau has three rigs seeking commercial production from Mississippian rocks.

Twenty exploratory rigs are listed for Manitoba and Saskatchewan provinces.

Development drilling . . . Nesson anticline in North Dakota accounts for 20 out of 21 development rigs working in this portion of Williston. Other rig concentrations are found in eastern Montana in Glendive field, Dawson County, on the Cedar Creek anticline, and in East Poplar field of Roosevelt County.

Another 20 development rigs are working in fields in Manitoba and Saskatchewan in proving up Jurassic, Misssisippian, and Cretaceous reservoirs on the northeast limbs of the Williston basin.

Montana Field

Drilling contractors active on the Montana side of the Williston basin include: Brinkerhoff Drilling Co., Casper; Clark Drilling Co., Billings; Delta Drilling Co., Tyler, Tex.; H. & H. Drilling Co., Casper; Hewitt-Gulick Drilling Co., Richey, Mont.; Kidd-Williams Drilling Co., Tulsa; R. L. Manning, Inc., Denver; Will I. Lewis Drilling Co., Denver; Lowell Drilling Co., Denver; Mountain States Drilling Co., Circle, Mont.; Pennant Drilling Co., Tulsa; Pioneer Drilling Co., Casper; Sprecher Drilling Co., Poplar, Mont., and Zach Brooks Drilling Co., El Dorado, Ark.

Drilling Practices

On developmental wells drilling on the Cedar Creek anticline a 15½-in. bore hole is cut for the surface and a string of 10¾-in. pipe set; about 900 to 1,100 sacks of cement are placed behind the pipe. Long hole is usually 9 in. to the Ordovician, Silurian, Devonian, or Mississippian objectives and a string of 5½-in. pipe is set on bottom. About 600 sacks of slow-set cement are placed behind the pipe.

Shell Oil Co. requires contractors to hold the hole to within 2° from surface to 3,000 ft., to 3° from 3,000 to 6,000 ft., and within 4° from 6,000 ft. to total depth.

Well-logging programs are arranged separately for exploratory wells and development wells. Exploratory wells are surveyed by conventional electric logs and MicroLog to the Piper lime. In addition one or two intermediate runs are made with the MicroLog and the LateroLog. At total depth, LateroLog, MicroLog, limestone log and the gamma ray-neutron logs are run.

Completion practices commence with gun perforating the pay section with cone shots using a density of four shots per foot. Since the eastern Montana reservoirs are principally limestones and dolomites, wells are acidized on completion. The amount of acid varies from 10 to 100 gal. per foot; and one of the factors considered is the height above the water table.

Flowing wells are equipped with 6,000-psi-test christmas trees. Pumping-beam installation at Little Beaver field, for example, has a 324,000-in.-lb. capacity unit powered by a 605-cu.-in. gasoline engine. Wells are equipped with 2½-in. tubing.

A typical production battery employs two 1,000-bbl. stock tanks and a heater treater.

Crude-Oil Properties by Geologic Formations—Some Fields in Williston Basin.

FORMATION	CHARLES	CHARLES	CHARLES	MISSION CANYON	DEVONIAN	MIDDLE DEVONIAN		
WELL	RICHEY N.P.I	MURPHY EAST POPLAR UNIT I	HUSKY N.P.I	AMERADA DILLARD I	PINE UNIT	AMERADA IVERSON I		
INTERVAL	7103 – 7270'	5630 – 5692'	6817 – 6829'	8420 – 8529'	8910 – 8970'	10490 – 10530'	11630 – 11680'	11749 – 11797'
PROPERTIES								
GRAVITY API	37.0°	33.6°	27.3°	41.4°	33.9°	40.7°	51.2°	43.1°
POUR POINT	+35° F	+5° F	+17° F	-60° F	-20° F	+80° F	-5° F	+40° F
SULPHUR	0.65%	0.44%	1.21%	0.3%	0.43%	0.14%	0.08%	0.32%
GASOLINE	34.5%	17.5%	30.0%	43.5%	29.0%	27.9%	58.3%	35.8%
GAS - OIL	35.1%	21.2%	30.0%	37.6%	35.2%	33.3%	28.0%	19.3%
HEAVY OIL RESIDUM	29.0%	60.0%	40.0%	17.7%	35.8%	37.2%	12.4%	43.0%

Fishing jobs can develop from key seats in the upper 3,000 ft. of bore hole of wells drilled along the Cedar Creek anticline. This section lies principally in the Cretaceous system.

North Dakota Fields

Along the Nesson anticline, 19 rotary drilling rigs are active in development wells in Williams, McKenzie, Mountrail, and Burke counties, North Dakota. At this writing a total of 186 oil wells have been completed along the anticline's 53-mile length. Beaver Lodge has 104 oil wells, Tioga 74, Charlson 3, Hofflund 2, and South Charlson, Croff, and Tioga East 1 each.

Concentration of drilling rigs is principally in the Beaver Lodge and Tioga fields where 17 are working on 8,600-ft. contracts to the Mission Canyon limestone of Mississippian age. Operators engaged at this time in development work on the Nesson anticline include: Amerada Petroleum Corp., Tulsa; Hunt Oil Co., Dallas; M. B. Rudman and New Concord Development Co., Dallas; Stanolind Oil & Gas Co., Tulsa; The Texas Co., Denver, and Warren Petroleum Corp. Tulsa.

Contractors active at present in Nesson anticline fields include: Gabe

PENETRATION RATES FOR DEVELOPMENTAL WELLS, CEDAR CREEK ANTICLINE, MONTANA—NUMBER OF FEET DRILLED PER 24 HOURS ON BOTTOM (ROCK BITS)*

Interval analyzed—	Little Beaver	Pine Unit	Glendive	Richey	East Poplar
Surface to Dakota	850 to (?)	600 to 750	500 to 1,100	500 to 750	750 to 1,000
Dakota to Madison	175 to (?)	220 to 310	175 to 275	250 to (?)	120 to 900
Below Madison	85 to (?)	60 to 80	55 to 75		

*Data by E. A. Polumbus, Jr., and D. J. Low.

RESERVOIR DATA—CEDAR CREEK ANTICLINE FIELDS, MONTANA
(Data: Shell Oil Co.)

Wells—	Little Beaver	Cabin Creek	Pine	Glendive	Southwest Richey	Richey
Producing wells	3	1	6	7	3	10
Dry holes	0	0	3	0	0	3
Drilling wells	0	0	1	2	1	0
Producing depth, average feet	8,500	8,900	9,000	9,100	9,200	7,100
Produced gas-oil ratio, cu. ft. per bbl.	200	300	200	250	650	250
Produced oil gravity, °A.P.I.	28	33	33-36	38	48	38
Reservoir pressure, orig., psig.	3,830	4,130	4,200	4,300	4,415	3,540

McCall Drilling Co., Casper; Helmerich & Payne, Inc., Tulsa; Noble Drilling Co., Tulsa; Loffland Brothers Co., Tulsa and Denver; Penrod Drilling Co., Dallas; Regent Drilling Co., Calgary; Rowan Drilling Co., Fort Worth; Paul F. Rutledge, Santa Fe; and Worley & Harrell, Inc., Tulsa. Standard Drilling & Exploration Co., Minot, N. D., operates a workover rig in the field.

Day work . . . Nearly all of the drilling contracts made on the North Dakota side of the Williston basin are written on a day-work basis due to the high volume of coring and drill-stem testing which makes it disadvantageous to the contractor to write a straight-footage contract.

Current prices are reported of from upwards of $1,000 per day with the company paying for rental of drill pipe.

Drilling Practices

On the Nesson anticline, drilling-weight practices are similar to those employed at Cedar Creek. From surface to top of the Dakota, weights of 3 to 10 tons are employed with high mud volumes and pressures. From the Dakota to the Madison weight on bit varies from 8 to 15 tons. Below the Madison weights vary from 10.5 to 20 tons including from 10 to 15 drill collars ranging from 6 to 6¾-in. o.d. Little difficulty has been encountered in keeping Nesson anticline boreholes vertical.

Rotary speeds employed follow these ranges:

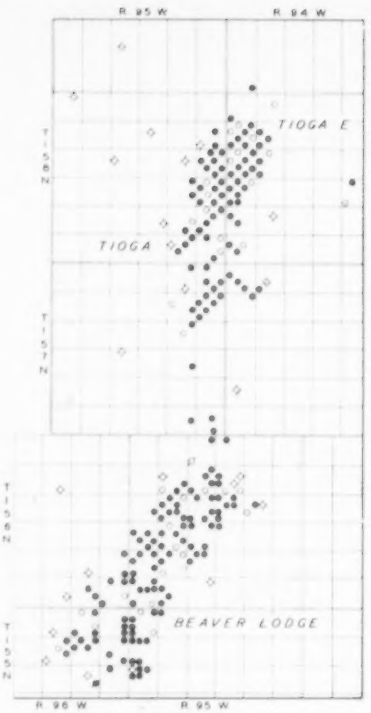
Interval	Table speed, r.p.m.
Surface to Dakota	100 to 150
Dakota to Madison	75 to 100
Madison and below	40 to 75

Pressures from 400 to 900 psi. are used from surface to the Dakota. From Dakota to the Madison this interval moves up to 900 to 1,100 psi. and below the Madison from 900 to 1,200 psi. At lower depths, pressures remain high but volumes circulated are lower.

Bore-hole and casing sizes . . . Usually a 13¾-in. bore hole is cut for the surface pipe and a string of 10¾-in. pipe set to a depth of about 600 ft. About 500 sacks are placed behind the pipe.

Long hole is cut with 8¾ or 9-in. bit to the base of the Mission Canyon limestone producing horizon. Either 5½ or 7-in. casing is set through the pay and cemented with 600 sacks.

On Devonian exploratory wells a 17½-in. bore hole will be cut to about 628 ft. and a string of 13⅜-in. pipe set and cemented with 450 sacks. Intermediate hole will be cut with a 12¼-in. bit and a string of 9⅝-in. pipe will be set to about 8,650 ft. and cemented with 1,502 ft. Long hole will be cut with an 8⅝-in. bit.



PRINCIPAL PRODUCING POOLS on the Nesson anticline are Beaver Lodge and Tioga fields.

Jet drilling . . . Since June 1952, jet drilling bits have been employed in drilling Mission Canyon wells at both Beaver Lodge and Tioga fields with important savings in bits and day work. From 22 to 28 jet bits have been used in drilling Mission Canyon wells as compared to 30 to 38 conventional bits to the same objective. One popular slush pump in this area is a 7¾ by 18-in. unit with 350 output horsepower which develops pressures up to 1,100 psi. with 6¾-in. liners and 1,300 psi. with 6¼-in. liners.

Worley & Harrell, Tulsa, Rig 2, working for Amerada Petroleum Corp. at A-1 Clifford Rice in Tioga East field cut 3,126 ft. of hole in 25½ hours using jet bits in conjunction with 6¾-in. liner with 1,000 psi. of pump pressure.

Coring on development wells at Beaver Lodge and Tioga at this writing is limited to three or four cores per well over a section of about 58 ft. Most popular diamond-head size is 6¼-in.

Well surveying utilizes MicroLog and gamma ray-neutron to identify porosity intervals as a guide for gun perforating to supplement conventional logs.

The casing is perforated opposite porosity intervals in the Mission Canyon with a shot density of four jet shots per foot. Gross pay sections have been logged up to 100 ft. in thickness. Initial acid treatments range from 500 to 5,000 gal.

Mission Canyon . . . Porosity of the Mission Canyon is described as intercrystalline limestone with small vugs and hair-line fracturing. However, in a few wells, reservoir behavior indicates the formation may be fractured. At Tioga, lithology of the Mission Canyon has been summarized as follows:

Upper portion (8,310 ft.) limestone, light gray, conchoidal, microcrystalline, earthy with small vugs.

Lower portion (8,375 ft.) limestone, dense gray, conchoidal, with pin-point porosity.

Both Beaver Lodge and Tioga fields possibly, may operate under a water drive. Oil-water contacts recognized are: Tioga—5,900 ft., and Beaver Lodge—6,190 ft. There has been some water encroachment and two wells on the edge of the field which once made pipe-line oil are now producing 100 per cent water.

Wells to this objective are drilled and completed in about 36 days from time of rigging up to moving off. All completions to date have been made in this formation.

Mud Program

Mud program in Beaver Lodge and Tioga fields has been stabilized to a considerable degree. Nearly all of the wells are drilled to the Mission Canyon objective in from 30 to 35 days with a mud cost of from 30 to 40 cents a foot.

Two distinct lithologies are encountered in these fields which require different types of drilling fluids. The upper group, ranging from surface to 5,500 ft., is shale with some sandstone accompanied by considerable bentonite; this requires the use of a fresh-water mud.

The lower group, extending from 5,500 ft. down through the Devonian, consists mainly of limestone with some sandstone and shale with considerable evaporites present. In the lower section, anhydrite and gypsum are found and salt is present in extensive amounts throughout the Spearfish (Triassic) Charles (Mississippian) and Devonian formations.

William Huddleston, mud engineer, Williston, N. D., reports that a mud with a viscosity of 35 seconds A.P.I. is used for spudding and setting the

THIS MAST JOB typifies current drilling operations in Beaver Lodge oil field, Williams County, North Dakota.

10¾-in. surface casing at around 600 ft. Water is used to drill out the cement and comprises the drilling fluid down to 3,500-4,000 ft. From this point to 5,500-5,700 ft., mud with a viscosity of 36 seconds is employed; at this latter point, the mud is converted into a gypsum-contaminated My-Lo-Jel mud using a preservative with from 10 to 15 per cent crude oil added to lighten it and to help prevent drill pipe corrosion. This mud is used to complete the hole.

Lost circulation . . . While cutting surface hole, circulation losses are experienced occasionally in the lignite beds from 200 to 400 ft. below the surface. This condition is corrected with the application of from 3 to 5 lb. per barrel of lost-circulation materials. In the first few wells drilled in the field considerable difficulty was experienced with the upper shale making mud. This was due to the lack of water to add to the mud. It was found that from 0.1 to 0.5 lb. per barrel of phosphate additive would offset the water shortage. Spudding fluids are either mud and bentonite, or Magcogel and water.

Since the shallower shale does not stand up very well with clear water as a circulating medium, it is advisable to raise the viscosity to about 40 seconds. However, below 3,500 ft. it is necessary to maintain the viscosity around 36 seconds to help prevent shale from caving into the hole.

In the 5,500 to 5,700-ft. zone, it is necessary to convert to a gyp-contaminated mud due to the anhydrite which occurs in the lower Piper limestone and which continues to total depth; water is added until the viscosity is changed to 33 to 34 seconds. Two to three pounds of gypsum per barrel are added to the mud through a chemical barrel along with ½ lb. per barrel of preservative and 2½ to 3½ lb. of My-Lo-Jel per barrel, resulting in a mud with a water loss of from 10 to 12 cc. and with a viscosity of from 36 to 45 seconds depending upon the amount of solids present in the mud at the time of conversion. Gel strengths are held at from 30 to 40 g. If viscosity drops below 40 seconds, salt gel is added to raise viscosity to 45 seconds. Crude oil may be added at this point to lower weight.

At Beaver Lodge and Tioga fields, the Piper section is comprised of an upper section of 200 ft. of shale and a lower section of 200 ft. of limestone and anhydrite. At the time of conversion in the top of the Piper, the mud contains from 500 to 1,000 p.p.m. chloride ion. After the Triassic Spearfish is drilled, the chloride ion content ranges from 60,000 to 80,000 p.p.m. When the Mississippian Charles salt is drilled, the chloride ion content is increased to 100,000 to 130,000 p.p.m. Addition of the salt lowers gel strength and increases the weight of the mud, but has very little effect upon the water loss and the Fann viscosity. Little trouble has been encountered due to the washed-out salt section.

Before running logs, it is advisable to raise viscosity to 55 to 60 seconds with salt gel to hold fallen shale or cuttings in suspension. The 5½ or 7-in. long string is run through the Madison (8,600 ft.) using this mud. If the well is drilled below the Madison, the same mud is used, but it is necessary to maintain water loss at from 6 to 8 cc. due to increased pressures and temperature encountered. The bottom-hole temperature of a Devonian well at Beaver Lodge is around 250° to 275° F.

Natural-Gas Processing

Tioga gasoline plant . . . Construction is under way for a $15,000,000 natural-gasoline plant for the Nesson anticline fields to be erected east of Tioga, N. D. It is being built jointly by Signal Oil & Gas Co. and Amerada Petroleum Corp. Amerada will receive title to the residue gas. The plant will be capable of processing 40 M.M.c.f. of gas per day, and plant production will be 150,000 gal. of natural gasoline and liquefied petroleum products per day. In addition, 50 tons of sulfur per day will be extracted from the sour gas.

Crude-Oil Marketing

The Williston basin has entered a period wherein more oil is being produced than can be sold but not enough oil has been discovered to earn a market.

North Dakota's 183 wells in production at the beginning of the third quarter were restricted to about 14,500 bbl. daily while the 67 producers in the eastern Montana portion of the Williston basin were limited to about 7,300 bbl. because of marketing difficulties.

High-cost transportation and the current surplus of crude penalize Williston producers who are trying to break into existing markets. Only the three best-developed fields have gathering systems, Beaver Lodge and Tioga in North Dakota, and East Poplar in Montana. However, The Texas Co. is building a gathering system in the Glendive, Mont., area. In other fields crude must be trucked to a railhead. With one exception Williston crude must be shipped hundreds of miles to refineries, resulting in such high-cost transportation that it can't compete with Mid-Continent and Rocky Mountain pipe-lined crude even though sold for 90 cents to $1.38 less a barrel at the well.

All but about 100 bbl. a day of

PENETRATION RATES FOR DEVELOPMENTAL WELLS, NESSON ANTICLINE FIELDS, N. D.*

Number of feet drilled per 24 hours on bottom (rock bits).

Interval analyzed—	Beaver Lodge	Tioga	Croff
Surface to Dakota	980 to 1,675	970 to 1,320	760
Dakota to Madison	185 to 280	190 to 220	126
Madison to Devonian	65 to ?		52
Devonian and below	88 to ?		62

*Data by E. A. Polumbus, Jr., and D. J. Low.

North Dakota's production comes from the Nesson anticline fields, principally from Beaver Lodge and Tioga. Stanolind Oil Purchasing Co., of Tulsa, buys all Nesson crude, paying $2 per barrel at the well.

Nearest market is Northwestern Refining Co. at St. Paul Park, Minn., which has been a variable market. Last winter Northwestern was purchasing a peak of 2,400 bbl. daily. During the summer, however, when Northwestern steps up asphalt production, it buys no North Dakota crude, which hasn't enough heavy bottoms for asphalt.

The next closest markets are refineries in the Superior, Wis., area and at Sheboygan, Wis. However, Superior has contracted for Alberta crude, delivered by Interprovincial and Lakehead pipe lines at a cost of $3.11 prior to the 26-cent price increase. Since Nesson crude can be delivered for $3.10, Stanolind is hopeful the increase in price of Alberta crude may enable North Dakota to break into this market. Bottineau County production has been trucked from the field to Superior at a delivered cost less than that of Nesson crude (see Table 1). Bottineau crude also can undercut Nesson crude at St. Paul Park because only $1.70 is paid at the well.

Considerable Nesson crude was purchased by Sheboygan until C. C. Thomas, an independent with four producing wells in East Poplar field, cut into the North Dakota market by taking $1.52 per barrel at the well to overcome a longer rail-haul disadvantage.

With the three nearest markets all but dried up, Stanolind has marketed an increasing amount of Nesson crude at the Whiting, Ind., refinery of its parent company, Standard Oil Co. (Ind.). Nesson crude is high priced at Whiting (see Table 2) but Standard is buying it to help maintain a North Dakota market which it will need next year when its 30,000-bbl. refinery being constructed at Mandan, N. D., goes on stream.

A Phillips Petroleum Co. refinery at Spokane, Wash., has been buying from 1,800 to 2,000 bbl. daily but this market will be lost this fall when the refinery shuts down. If North Dakota crude can be sold at Superior it probably will do no more than make up for loss of the Spokane market.

Some North Dakota crude has been sold at Kamsack, Sask., but this has been so sporadic it is not considered of marketing importance.

Except for the four C. C. Thomas wells, East Poplar field in eastern Montana is a unitized field with C. H. Murphy, Jr., of El Dorado, Ark., the operator. Phillips and Carter Oil Co. have large interests in the unit; crude from East Poplar has been shipped to the Phillips refinery at Spokane. Murphy, who has built a gathering system in the field, faces loss of this market when the refinery closes.

Carter, Continental Oil Co., and the Farmers Union operate refineries at Billings and nearby Laurel, Mont., but these plants all use Wyoming and Colorado crude. With exception of Pine Unit oil which is being purchased at Laurel, crude oil produced on the Cedar Creek anticline must be sold at a distance even though most of the wells are only about 300 miles from Billings.

Shell Oil Co., which has extensive production, has the costliest marketing of any producer in the basin. Shell production from Richey, Glendive, Cabin Creek, and Little Beaver fields is trucked to railheads, shipped by tank car to Seattle or Portland, where it is transferred to ocean tankers for shipment to Shell's refinery at Martinez, Calif.

The Texas Co. has worked out a route which utilizes the Platte pipe line for the longest part of the haul. Crude is shipped from Glendive by rail to Frannie, Wyo., where it enters feeder lines to the Platte pipe line originating at Worland, Wyo. From the terminal at Wood River, Ill., Glendive crude is switched to a pipe line into Texaco's refinery at Lockport in the Chicago refining area. This 38°-gravity oil can be delivered at a cost of $3.42 with a price of $1.95 at the well.

At present the only assured improvement in marketing will come in North Dakota next year, when Standard's Mandan refinery goes on stream. Service Pipe Line Co., which has built the gathering system in Beaver Lodge and Tioga, also is building a trunk line from Tioga to the Mandan refinery so next year this created market will enable a daily production of 30,000 bbl. daily, with a higher price at the well.

Aside from this refinery, only a small increase in production is expected. Work has started on a 1,500-bbl. refinery at Williston, 50 miles east of Beaver Lodge and Tioga, and plans have been announced for two more small refineries, a 2,000-bbl. plant at Dickinson, N. D., and a 2,500-bbl. refinery at Minot, N. D.

While there have been reports of pipe lines planned for eastern Montana none have materialized as yet nor have any refineries been announced to brighten the market outlook.

Following are listed the refineries where Williston basin crude has been marketed, with the field price and delivered cost per barrel:

TABLE 1

Field—	Field price	Delivered cost
St. Paul Park, Minn.		
Nesson anticline	$2.00	$3.07
Bottineau	1.70	2.87
Duluth-Superior		
Bottineau	$1.70	$2.75
Leduc-Redwater	2.74	3.36
Nesson*	2.00	3.10
Sheboygan, Wis.		
Nesson	$2.00	$3.45
East Poplar	1.52	3.10
Chicago		
Nesson	$2.00	$3.56
Glendive†	1.95	3.42
Spokane, Wash.		
East Poplar	$2.01	$3.52
Nesson	2.00	3.58
Martinez, Calif.		
Richey	$2.00	$4.54
Glendive	1.68	4.22
Cabin Creek	1.60	4.12
Little Beaver	1.55	4.08
Billings-Laurel, Mont.		
Pine Unit	$1.87	$2.43

*None sold at Duluth-Superior yet. †Via Platte pipe line.

Table 2 shows the breakdown on costs of Williston basin crude delivered to the Chicago area compared to pipeline crude. North Dakota crude from the Nesson anticline moves entirely by rail; Glendive, Mont., oil by rail and the Platte pipe line.

TABLE 2

	Nesson	Glendive	Wyoming	West Texas
Gravity, °A.P.I.	42.4	38.0	40.0	44.0
Field price	$2.00	$1.95	$2.90	$2.90
Tender deduction	0.01	0.03	0.014	0.014
Gathering and/or trucking	0.125	0.222	0.075	0.075
Trunk tariff	None	0.40	0.41	0.38
Rail rate	1.41	0.81	None	None
Unloading	0.01	0.01	None	None
Delivered cost	$3.555	$3.422	$3.399	$3.369

BONANZA OIL FIELD on the northeast limb of the Big Horn basin has 33 oil wells producing more than 5,000 bbl. daily from the 2,550-ft. Tensleep sandstone reservoir.

BIG HORN . . .

Biggest Producing Basin in the Rockies

FIELDS in the Big Horn basin yield more than 50 per cent of the oil produced in the State of Wyoming and 30 per cent of the oil produced in the entire Rocky Mountains. Though this basin includes an area of only 3,000 sq. miles, it is the biggest producing basin in the Rocky Mountains.

The Big Horn basin has seen many advances in exploratory techniques in recent years. Structures with shallow Cretaceous fields have been drilled deeper to productive Permian, Pennsylvanian, and Mississippian rocks and have been found to exhibit increasing closure with depth. In 1945 the seismograph began to be used for exploratory mapping, previously restricted to the plane table and alidade, and proved that there were oil-bearing structures away from the basin's rims beneath a blanket of essentially flat-lying Tertiary sediments. A search aimed at finding stratigraphically trapped oil was successful in the southeastern part of the basin in 1947. The discovery of oil at Bonanza in 1950 proved that surface closure is not needed for closed traps at depth. Sage Creek-Tensleep, discovered in 1952, proved that the tilted-water-table theory of exploration has practical application.

Geologic Sketch

The Big Horn basin is a well-defined topographic and structural depression in northwestern Wyoming. It is bounded on the northeast by the Big Horn Mountains, on the south by the Owl Creek-Bridger Mountains, on the west by the Absaroka range, and on the northwest by the Beartooth Mountains. There is no topographic break northward into Montana through a thin neck of the basin which is bounded on the east by the Pryor uplift.

All of the bordering mountains except the Absaroka range were elevated in late Upper Cretaceous time. The volcanic Absarokas came into existence in early Eocene time. Throughout the time preceding the first period of mountain making, the Big Horn basin area was on a shelf of the Cordilleran geosyncline, the axis of which lay to the west, and was periodically covered by shallow epicontinental seas during Paleozoic time.

In an east-west direction across the Big Horn basin the strata dip rather gently from the Big Horn Mountains toward the axis of the basin and rise comparatively steeply onto the volcanic mountains to the west.

There are two prominent lines of surface-expressed folding within the basin which include well-defined anticlines roughly paralleling the bordering mountain ranges. With few exceptions the fields of the basin are restricted to the edges of the basin on these series of satellite anticlines. The exceptions are fields located by seismic work during recent years.

Producing formations . . . Sediments in the Big Horn basin range in age from Recent through Cambrian. The maximum sedimentary section is estimated to be about 17,000 ft. To date production has been found in the Cretaceous (Frontier, Mowry, Muddy, Dakota, and Lakota), Triassic (Morrison and Sundance), Jurassic (Chugwater), Permian (Phosphoria), Pennsylvanian (Tensleep and Amsden), and the Mississippian (Madison). As there have been very few tests of pre-Cretaceous rocks in the central portion of the basin and of pre-Mississippian rocks anywhere in the basin, these rocks cannot be ruled out as being potentially productive.

Some Significant Fields
(See accompanying table)

Many large oil fields contribute toward making the comparatively small Big Horn basin the Rocky Mountains' biggest producer.

Nearly all of the big fields of the Big Horn basin are on surface-expressed anticlines near the margins of the basin. Production is chiefly from the Phosphoria, Tensleep, and Madison, and is black oil containing varying percentages of sulfur. The sweet green oil produced in the basin comes from Cretaceous sands, and most of the

fields that produce Cretaceous oil are on the decline.

Elk Basin . . . The largest producing field in Wyoming is Elk Basin. In current production this field is second only to Rangely in the entire Rocky Mountain region. Proved remaining reserves of oil at Elk Basin are estimated at 200 million barrels. Only Rangely, with 220 million barrels, has a greater estimated reserve in the Rockies.

A total of more than 72 million barrels of crude has been produced from Elk basin field of Wyoming and Montana. This field is a highly faulted anticlinal structure lying in the north end of the Big Horn basin. More than 800 ft. of surface closure is known. Nearly 5,000 acres has been proven productive from the Frontier, Embar, Tensleep, and Madison reservoirs at depths ranging from 1,084 to 4,470 ft.

Discovery well was completed in 1915 producing 50 bbl. of oil per day from the Torchlight and Peay sands at 1,070 to 1,270 ft. However, discovery of oil in 1942 from the Tensleep formation gave the field its major impetus; this formation was proved productive by Minnelusa Oil Co., Yale Oil Co. and Henderson Producing Corp. 1 Henderson, NE NE NE 31-58n-99w, flowing 80 bbl. of oil per hour from 4,488-4,538 ft.

Average production during April 1953 was 14,052 bbl. daily, of which 10,521 bbl. came from the Embar-Tensleep from 128 wells, 3,277 bbl. daily from the Madison from 27 wells, and 254 bbl. daily from the Frontier from 141 wells.

Frannie . . . The discovery well of Frannie was completed in the Tensleep in 1928 and the following year Madison production was established. The Tensleep reservoir at Frannie is "hung" on the west flank of the structure, apparently as a result of hydrodynamics. The oil-water contact in this reservoir has a known tilt of 1,300 ft. and development of the field is still moving downdip. Frannie is the second largest producing field in Wyoming.

REPORT • ROCKY MOUNTAIN OIL

Garland . . . The first oil field discovered in the Big Horn basin was Garland. This field was opened in 1906 when green oil was found in the Frontier. As with most of the old fields in the basin, Garland has been deepened and now produces oil and gas from the Embar, Tensleep, and Madison formations.

A prominent surface structure in the northern part of the Big Horn basin, Garland is a faulted anticlinal fold with a surface closure of 2,500 ft. in the Cretaceous Cody shale. Prolific in recovery from the Embar-Tensleep, Garland has produced 15,572,000 bbl. of oil from this reservoir to January 1, 1953. In addition, Mississippian Madison limestone has yielded 7,876,000 bbl. to the same date. Current field production averages about 11,000 bbl. gross daily.

Most of Garland field output is controlled by two separate units operated by Ohio Oil Co. They comprise Kinney Coastal unit in the northern part of the field, and the Utah Southern-Ohio Garland unit in the south-central part of the field.

Garland field was discovered in the Frontier formation in 1906 when 40°-gravity oil was found at a depth of 624 ft. Gas production was discovered from the Cloverly formation in 1915 at a depth of 3,000 ft. Although gas was discovered in the Embar-Tensleep in 1927, the oil ring was not discovered until 1943. Madison limestone pay discovery in 1930 yielded 21°-gravity black oil.

Byron field . . . Two miles northeast of Garland field lies Byron field on a faulted anticline on the northeast rim of the Big Horn basin. Prolific in recovery from the Embar-Tensleep, Byron has produced 22,227,000 bbl. of 22°-gravity oil from this reservoir.

As of January 1, 1953, 48 oil wells were still producing from the Embar-Tensleep and current daily production is about 5,600 bbl.

Byron field was discovered in 1918 when gas was found in the Frontier sand at a depth of 2,430 ft. Oil was discovered in the Sundance in 1929. The following year Ohio Oil Co. dis-

Drilling and Production Data, Big Horn Basin

Field and county—Producing name and formation age—	Year disc.	Type Str.*	Pay depth	Grav. oil, °A.P.I.	Wells: Flowing	Wells: Pumping	Wells: Total	Wells: Drlg.	Acres proved devel.	Oil production: B/D	Oil production: Cum. 7-1-53
WYOMING, OIL:											
Bonanza, Big Horn — Tensleep — Pennsylvanian sand	1951	Af	2,705	34			33	0	720	5,028	3,231,151
Byron, Big Horn—Embar, Tensleep—Permian, Pennsylvanian, dolomite, sand	1930	Af	2,070-5,070	18-51			53	0	1,880	4,550	28,030,176
*Elk Basin, Carbon and Park—Frontier, Embar, Tensleep, Madison—Cretaceous, Permian, Pennsylvanian, Mississippian, dolomite, sand	1915	Af	1,084-4,470	30-45			296	0	4,948	14,052	72,125,029
Frannie, Carbon and Park—Tensleep, Madison — Pennsylvanian, Mississippian, dolomite, sand	1928	Af	2,565-2,925	18-26			118	4	1,410	10,780	27,418,636
Gebo, Hot Springs—Embar, Tensleep—Permian, Pennsylvanian, dolomite, sand	1942	A	4,510-4,850	29			35	1	705	2,436	4,085,964
Garland, Big Horn—Frontier, Embar, Tensleep, Madison — Cretaceous, Permian, Pennsylvanian, Mississippian, dolomite, sand	1906	Af	500-1,650	21-24			87	1	1,480	7,967	25,559,910
Grass Creek, Hot Springs—Frontier, Embar, Tensleep—Cretaceous, Permian, Pennsylvanian, dolomite, sand	1914	A	2,580-2,650	24-45			248	9	1,540	10,094	45,998,141
Hamilton, Hot Springs—Embar, Tensleep, Madison—Permian, Pennsylvanian, Mississippian, dolomite, sand	1919	Af	2,162-3,048	14-23			96	1	1,140	9,929	28 135,806
Lake Creek, Hot Springs—Embar, Tensleep—Permian, Pennsylvanian, dolomite, sand	1925	A	3,097-3,253	22-31			10	0	190	1,004	1,177,254
Little Buffalo Basin, Hot Springs and Park—Embar, Tensleep—Permian, Pennsylvanian, dolomite, sand	1943	A	1,135-4,453	20-21			16	0	1,430	2,354	7,528,613
Manderson, Big Horn—Phosphoria—Permian, dolomite	1951	A	7,258	37			4	5	1,800	315	132,003
Murphy, Hot Springs—Tensleep—Pennsylvanian sand	1949	A	4,295	34			6	1	360	1,423	1,025,234
Oregon Basin, Park—Embar, Tensleep, Madison — Permian, Pennsylvanian, Mississippian, dolomite, sand	1927	Af	1,600-3,533	18-23			77	0	3,130	2,999	56,895,730
Worland, Washakie—Frontier, Embar—Cretaceous, Permian, dolomite, sand	1946	A	9,925	38-44			30	0	6,500	2,719	10,728,099
WYOMING, GAS:											
Byron South, Big Horn—Peay—Cretaceous sand	1952	A	3,059		1	0	1	0	640		
Five Mile, Big Horn—Phosphoria—Permian limestone	2-52	Af	11,740		1	0	1	0	640		
Fourteen Mile (Worland S.W.), Washakie—Phosphoria—Permian limestone	5-52	A	13,300		1	0	1	0	640		
Greybull West, Big Horn—Greybull—Cretaceous sand	1952	A	10,358		1	0	1	0	640		
Worland, Washakie — Frontier — Cretaceous sand, limestone	1950	A	7,108		6	0	6	0	3,840		

*Legend: A—anticline; Af—faulted anticline; T—terra ce; L—lenticular; Str—stratigraphic.

BLACK OIL from the Big Horn basin is processed in this 6,000-bbl.daily capacity crude-oil and asphalt refinery operated by Ohio Oil Co. at Lovell, Wyo.

covered oil from the Embar-Tensleep formation.

South Byron, which lies on the same structure as the main Byron field, but separated from it by a fault, has produced Frontier oil since 1950. However, there are only nine producing wells with current production of only 25 bbl. per day.

Ohio Oil, Mule Creek Oil Co., and Taylor Oil Co. are major working-interest owners in Byron field proper.

Worland . . . The discovery of Worland field developed interest in the Embar as a producing formation in the eastern portion of the Big Horn basin and indicated the potentialities of the masked structures away from the immediate margins of the basin.

The field is on a large asymmetric fold which trends northwest-southeast. Though there was some surface evidence of an anomaly, the field was discovered by seismic work. Because of the high gas-oil ratio of production and the high (30 per cent by volume) percentage of hydrogen sulfide in the gas, Worland field has been unitized for profitable operation. At the field there are plants for recovering sulfur and liquid hydrocarbons from the gas, which yields about 11 tons of sulfur.

Worland dome has about 1,000 ft. of closure on the Embar and about 700 ft. on the Frontier, which is currently being developed for sweet gas and 44°-gravity oil.

Bonanza . . . If the prevailing idea that no structural anomaly in the Rocky Mountains should be overlooked as a possible oil field can be attributed to one discovery, that discovery would be Bonanza. The opening of this most desirable field came as a rude awakening to many Rocky Mountain geologists.

The Bonanza anticline went essentially untouched for many years after it had been mapped because it had no defined closure at the surface. Now that an oil field has been developed, subsurface studies have demonstrated closure at depth.

Bonanza field has a thick (220-ft.) section of Tensleep pay at a depth of only 2,550 ft. The field lies just north of the water-flushed Nowood anticline but, apparently, because of a fault the oil traps at Bonanza were undisturbed by the flow of water.

Grass Creek . . . With a prominent surface structural expression, Grass Creek was drilled early in the development of Wyoming oil. For many years, this field ranked next to Salt Creek in production of light oil. First light-oil discovery was made in 1914 by W. L. Valentine at a depth of 900 ft. in the Cretaceous Frontier sandstone. By September 1918, 332 oil wells were completed from the Frontier. Cumulative recovery of light oil to January 1, 1953, was 31,047,000 bbl., and present production is 750 bbl. per day.

Black, asphaltic crude testing 24°-25° A.P.I. was discovered in 1922 in the Embar-Tensleep formation by Ohio Oil Co. at a well in NE NW 19-46n-89w. Cumulative recovery of heavy oil from 56 wells was 12,200,000 bbl. to January 1, 1953. Present field production from this reservoir is 5,000 bbl.

Currently, an active drilling program is under way in development of Curtis sandstone in Triassic Chugwater formation found at about 3,700 ft. To date, 70 oil wells have been completed from this formation of which 30 were drilled this year. Present field production from this reservoir is 5,000 bbl. per day. Crude from the Curtis is undersaturated and has in solution only 50 cu. ft. of gas per barrel of oil.

Operators engaged in Curtis sand development include Brinkerhoff Drilling Co., British-American Oil Producing Co., Ohio Oil, Pacific Western Oil Co., and Stanolind Oil & Gas Co. Recent stepout wells have shown the Curtis sand to be productive 1,180 ft. below the rest of the structure.

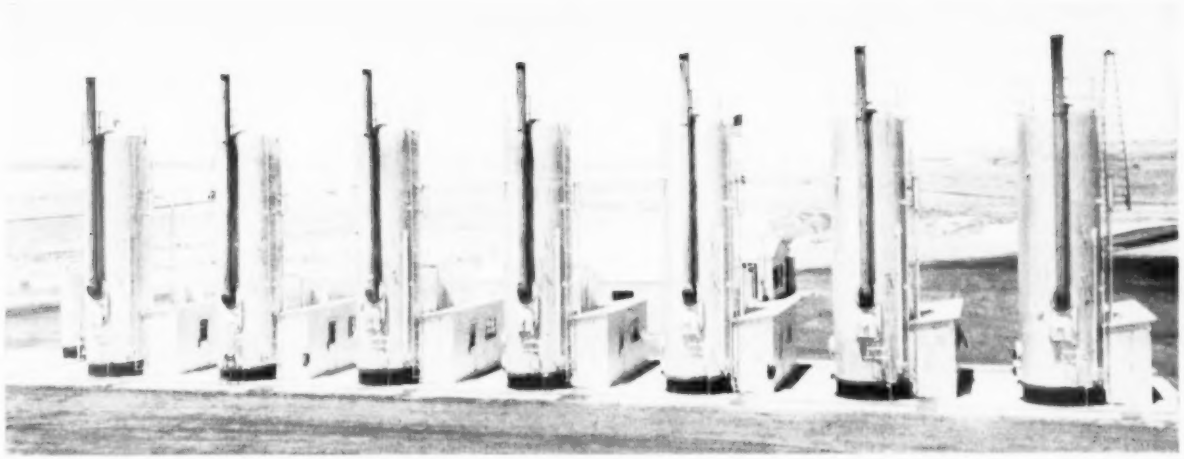
Major working interest owners in Grass Creek are Ohio, Stanolind, Fullerton Oil & Gas Co., British-American, Husky-Kinney Coastal Oil Companies, Brinkerhoff, Pacific Western and Gordon-Manning.

Grass Creek field is situated along the crest of a major line of folding on the southwest rim of the Big Horn basin, in T. 46 N., R. 98 and 99 W. It is a good example of a surface basin which characterizes many of the Rocky Mountain oil fields; it is a surface basin almost completely surrounded by prominent escarpments or rim rocks.

Little Buffalo basin . . . This structural feature occupies two elliptically shaped domes in northwestern Hot Springs County, Wyoming. More than 2,000 ft. of surface closure has been mapped in the outcropping Cody shale.

Its commercial importance lies in its high current production of 2,354 bbl. of crude daily from 16 producing wells in the Embar-Tensleep. The field has produced a total of 7,528,613 bbl. to July 1, 1953. Other production is found in the Triassic Curtis sandstone.

Stanolind Oil & Gas Co., one of the principal operators in this field, with 130 oil and 7 gas wells in the field, plans to drill 21 wells this year.



DEHYDRATION AND CRUDE-OIL TREATING is conducted in this seven-section unit serving 37 oil wells of Ohio Oil Co. and Kinney-Coastal Oil Co. in Garland field, Big Horn and Park counties, Wyoming.

Oregon basin . . . Impressive in cumulative recovery, Oregon Basin field has produced 52,100,000 bbl. of 22°-gravity oil from the Embar-Tensleep and 2,550,000 bbl. of 20°-gravity crude from the Mississippian Madison formation.

This field occupies a large topographic depression on the crest of a north-trending anticline lying on the west side of the Big Horn basin. In reality the field occupies two separate and distinct closed domes. There are four participating areas in a unit operation with Ohio Oil Co. as unit operator—North Embar-Tensleep, North Madison, South Embar-Tensleep, and South Madison. As of January 1, 1953, there were 179 Embar-Tensleep and 24 Madison wells on production. Current production is 15,000 bbl. daily from all formations.

Prompted by impressive surface folding, a shallow well was drilled in 1912 by Enalpac Oil & Gas Co. which discovered gas in the Cretaceous Cloverly formation. In March 1927, oil was discovered by Ohio Oil Co. in the Embar lime and Tensleep sand on the North dome at a depth of 3,650 ft. The following year oil was found in the Madison at a depth of 4,600 ft. by Yale Petroleum Co.

Major working-interest owners in Oregon Basin field are Ohio Oil, The Texas Co., Husky Oil Co., Trigood Oil Co., Pacific Western, and Kirk Oil Co.

Natural-gasoline plants . . . In the Big Horn basin are two natural-gasoline plants with a combined capacity of 2,636 bbl. of liquids per day including L.P.G. Stanolind operates a plant in Elk Basin field of Park County, 18 miles north of Powell, Wyo., with a capacity of 1,333 bbl. per day of liquids. Pure Oil Co. has a 1,303-bbl.-daily-capacity plant in Worland field of Washakie County.

Elk Basin Unit plant was designed as an integral part of a three-way conservation project designed to: (1) increase the ultimate recovery of oil from the reservoirs by injection of gas into the producing formations and by producing only the most efficient wells (a practice made possible only under unit operations); (2) recover propane, butane, and natural gasoline from the casing-head gas produced with the crude oil; and (3) recovery of sulfur from the otherwise dangerous and harmful hydrogen sulfide gas which contaminates the casing-head gas.

Gas processed in the Elk basin plant is produced with crude oil from 147 unit wells in Elk Basin field which produces from the Embar-Tensleep and Madison formations ranging in depth from 3,900 to 6,200 ft. Elk Basin Unit plant was designed to process 12.0 M.M.c.f. of casing-head gas per day and recover 56,000 gal. of liquid products and 74 long tons of sulfur. The plant can also generate 14 M.M.c.f. of inert gas each day for injection into the Embar-Tensleep producing formation.

Sulfur recovery . . . Commercial sour-gas reserves in Wyoming will probably total 400 million cubic feet and future discoveries may double this figure, according to James G. Crawford, chemical engineer, Casper, Wyo., who estimates that present reserves promise a recovery of from 4 to 5 million long tons of elemental sulfur.

Bulk of these commercial reserves lies in the Big Horn basin where it is associated with and probably derived from Permian rocks including the Phosphoria limestone. Concentration percentages ranges from 8 to 50 per cent by volume.

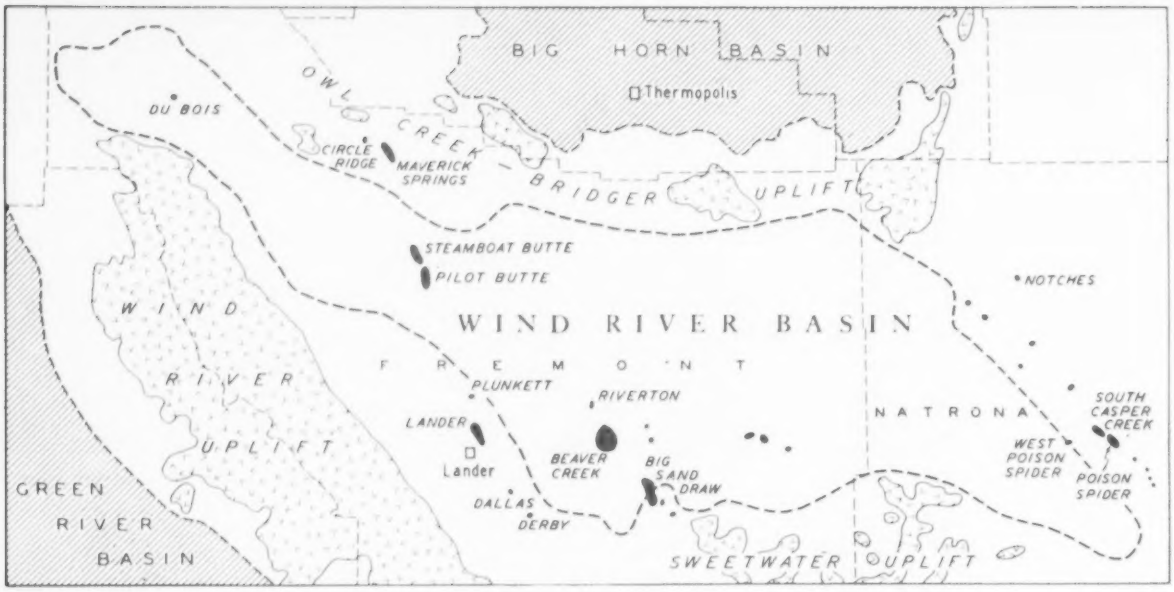
At the Elk Basin plant of Stanolind, hydrogen sulfide gas removed from the casing-head gas flows to the sulfur unit where commercial sulfur is recovered. Gas at Elk Basin field from the Embar-Tensleep reservoir contains a high percentage of hydrogen sulfide, above 18 per cent. Elk Basin sulfur is sold to industrial firms in the Rocky Mountains, the Pacific Northwest, and the Chicago area.

Since 1951, Texas Gulf Sulphur Co. has operated a sulfur-recovery plant in Worland field, 9 miles north of Worland, Wyo. Total investment was $4,000,000.

Gas produced from the Permian Embar reservoir averages 30 per cent of hydrogen sulfide and 2 per cent of carbon dioxide by volume. Extraction processes can recover approximately 10 tons of sulfur per million cubic feet of sour gas.

This plant is designed to process 30 M.M.c.f. of sour gas per day and sulfur recovery averages 300 tons a day. After Texas Gulf removes hydrogen sulfide and carbon dioxide from the gas, the sweetened gas is sent to Pure Oil Co.'s natural-gasoline plant in Worland field for recovery of propane, butane, and natural gasoline. Excess residue gas is sold by Pure to the Montana-Dakota Utilities Co.

Hydrogen sulfide removed from the sour natural gas is retained at the sulfur plant, subjected to a special catalytic process, and converted to elemental sulfur. Sulfur is then piped in the molten state to the stockpiles.



WIND RIVER . . .

A Geologically Complex Oil-Producing Basin

. . . of Central Wyoming

THE general structural and stratigraphic features of the Wind River basin are fairly well known, but, despite active exploration by surface mapping, geophysical surveying, and exploratory drilling, there remains much to be learned about this geological complex intermontane basin.

A number of important oil fields have been developed near the margins of the Wind River basin. Though the deep Tertiary-filled areas of the sedimentary unit have been worked more than those of any other Wyoming basin, there have been no Tertiary discoveries within the basin nor any discoveries not associated with surface-expressed anticlines.

Geologic Sketch

The Wind River basin lies between the Big Horn and Green River basins. It is well defined either by mountain uplifts or prominent erosional escarpments except on the east side.

The basin is bounded on the north by the southern portion of the Absaroka range and the Owl Creek-Bridger Mountains; on the east by a line of folding and faulting between the Laramie and Big Horn Mountains, which separates the Wind River and Powder River basins; on the south by the Sweetwater uplift; and on the southwest and west by the Wind River Mountains.

The Wind River basin is a major asymmetrical syncline with the basin axis near the northern limits of the structural depression. The basin is bordered by a series of sharp anticlines. Many of these anticlines, unlike those in most of the intermontane basins of the Rocky Mountains, do not parallel the basin margins. Furthermore these anticlines do not appear to have any direct relation to the over-all downfolding within the basin which is transverse to their principal axes. The central portion of the basin is filled with Eocene sediments which, in general, do not reflect the attitudes of the disturbed pre-Tertiary rocks.

This area was not drastically disturbed until the close of Upper Cretaceous time when the bordering mountains and most of the present structures were formed. The pre-Cretaceous section in the northwestern portion of the basin is not unlike that found in the Big Horn basin across the Owl Creek Mountains to the north. To the east, however, the Paleozoic section is thinner, not only because of thinning of individual units but because of the complete pinching out of some.

Oil-producing structures within the Wind River basin are found distributed almost in-line along the western border of the basin. The surface expressions of these productive anticlines do not parallel the Wind River Mountains, but trend more northward. Other oil fields are found along similarly trending anticlines farther to the east near the southern margin of the basin. On the east side of the basin oil fields are found on small separate closures superimposed on a major asymmetrical anticlinal fold that trends northwest-southeast just to the west of the line of folding and faulting between the Lamarie and Big Horn Mountains.

Producing formations . . . In the area of greatest downfolding of the Wind River basin there is an estimated 15,000 to 20,000 ft. of sedimentary rock section. All ages of rocks from pre-Cam-

Drilling and Production Data, Wind River Basin

Field and county—Producing name and formation age—	Year disc.	Type Str.*	Pay depth	Grav. oil, °A.P.I.	Wells: Flowing	Wells: Pumping	Wells: Total	Wells: Drlg.	Acres proved devel.	Oil production: B/D	Oil production: Cum. 7-1-53
WYOMING, OIL:											
Beaver Creek, Fremont — Mesaverde, Tensleep — Cretaceous, Pennsylvanian, sand, limestone	1938	A	3,575-8,045				22	1	977	1,682	1,813,195
Big Sand Draw, Fremont—Tensleep—Pennsylvanian sand, limestone	1944	Af	2,295-7,090	34			13	1	700	6,690	14,720,787
Circle Ridge, Fremont — Embar, Tensleep, Madison—Permian, Pennsylvanian, Mississippian, sand	1923	Af	400-1,630	24			38	3	350	2,785	4,488,322
Happy Springs, Fremont—Frontier, Muddy, Dakota, Lakota—Cretaceous sand	1950	A	3,983-5,986		8	7	15	3		1,503	561,669
Pilot Butte, Fremont—Cody, Embar, Tensleep—Cretaceous, Permian, Pennsylvanian, sand, shale	1916	Af	630-6,150	24-38			34	1	320	1,489	5,135,118
Poison Spider, Natrona—Muddy, Sundance—Cretaceous sand	1917	A	540-1,290	18	0	29	29	0	480	212	1,700,556
Poison Spider West, Natrona—Mesaverde, Frontier—Cretaceous sand	1948	A	9,230-14,195	44	2	0	2	0	350	123	556,418
Riverton, Fremont—Tensleep—Pennsylvanian sand	1949	A	11,667	46			5	1	160	467	634,808
Sand Draw North, Fremont—Tensleep—Pennsylvanian sand	1953	A	11,500	40.4	1	0	1	0	40		
Steamboat Butte, Fremont—Nugget, Lakota—Cretaceous, Permian, sands	1943	Af		26-38			40	2	1,500	10,607	21,660,799
WYOMING, GAS:											
Beaver Creek, Fremont—Frontier, Dakota—Cretaceous sand	1938	Af	7,060-8,045		9	0	9	1	4,730		†46,990
Big Sand Draw, Fremont—Frontier, Cloverly, Morrison—Cretaceous, Jurassic, sand	1918	Af	2,295-4,285		15	0	15	1	1,960		†23,271

*Legend: A—anticline; Af—faulted anticline; T—terrace; L—lenticular; Str—stratigraphic; M—monocline. †Million cubic feet.

brian to Recent, except the Silurian, are represented in the basin. Devonian rocks are restricted to the western portion. As a result of progressive eastward transgressive overlap from the Cordilleran geosyncline, which lay to the west, and the northwestward advance of epicontinental seas from the southeast, only the younger series of many of the systems are present in the Wind River basin.

Production in the Wind River basin has been found in the Cretaceous (Mesaverde, Cody, Frontier, Muddy, Dakota, and Lakota), the Triassic (Morrison and Sundance), the Jurassic (Nugget and Chugwater), the Permian (Phosphoria), the Pennsylvania (Tensleep), and the Mississippian (Madison).

Major Fields

(See accompanying table)

The Wind River basin is the third largest producing basin in Wyoming. Its production is surpassed only by that in the Big Horn and Powder River basins. Two fields, Big Sand Draw and Steamboat Butte, account for nearly half of the production in the basin. Winkleman Dome and Beaver Creek are the next biggest producers, in that order.

Big Sand Draw . . . The first production on the long, narrow, intensely faulted, steepsided Sand Draw anticline was gas in the first Frontier sand. Subsequent drilling proved gas in other Frontier sands, in the Muddy, Dakota, Lakota, and Morrison sands, and in the Phosphoria. In 1945 Tensleep production was discovered in the field. Ultimate recovery for the 300-ft.-thick Tensleep producing section at Big Sand Draw is estimated to be at least 50,000 bbl. of oil per acre.

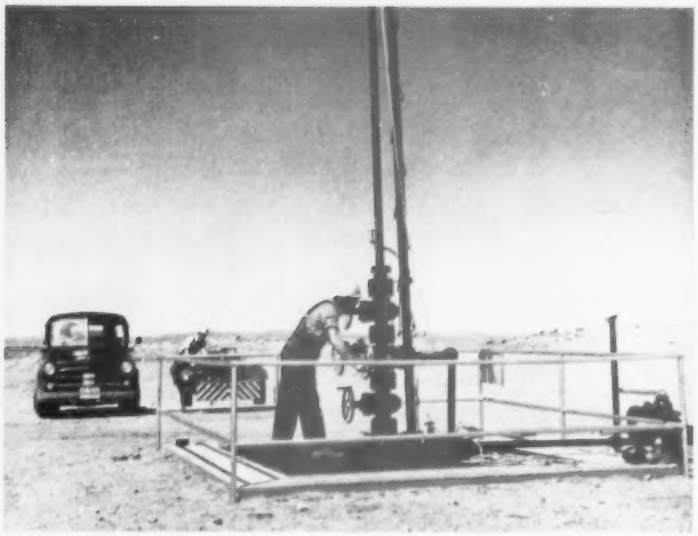
Beaver Creek . . . This Wind River basin oil and gas field was discovered in 1938 when a wet-gas well was completed in the Lakota sand. However, due to lack of outlet for production, development of Beaver Creek did not begin until 1944. The field now has wet-gas production from the Cretaceous in five Frontier sands, the Muddy, and the Lakota. In 1948 a deep test of the structure found 45°-gravity oil in a 260-ft.-thick section of Tensleep topped at 10,442 ft. In 1951 a Tensleep-bound well flowed oil from the Mesaverde to indicate the addition of yet another productive zone which has since been proved and partially developed in this multipay field.

The proved closure at Beaver Creek is about 1,200 ft. with the total closure of the structure yet to be established. The axis of the Beaver Creek anticline trends north-south in the surface Wind River beds but with depth the structural axis shifts to northwest-southeast to roughly parallel the southeastern margin of the basin. Beaver Creek and Riverton dome, a 1949 Tensleep discovery located 10 miles to the northwest, may be on the same structural axis.

Steamboat Butte . . . The majority of the production at Steamboat Butte comes from the Tensleep although the Nugget sandstone was the first producing reservoir discovered in the field. The Steamboat structure is north-south trending, elongate anticline with closure of 350 to 400 ft. A fault on the west side of the structure limits production in that direction. The oil-saturated Tensleep in this field reaches a thickness of about 300 ft.

Lander . . . The first commercial well at the intensely folded Lander field was completed in 1912 in the Embar limestone. Tensleep production was established in 1925.

The oil-water contact in the Embar at Lander field varies from about 2,500 ft. above sea level in the north end of the field to about 3,000 ft. in the north-central part of the field and to about 3,300 ft. at the south end of the field. At one point in the east-central area



IN BEAVER CREEK FIELD, this maintenance crew is cutting paraffin from a flowing well.

AT SHELDON DOME FIELD, Fremont County, Wyoming, this Phillips Petroleum Co. employe checks behavior of a pumping well.

of the field the oil-water contact is above 3,685 ft.

Big Sand Draw . . . This is one of the excellent Tensleep oil reservoirs in Wyoming, in the Wind River basin. During June 1953 the reservoir produced 5,958 bbl. of oil per day from 13 Tensleep wells. Cumulative recovery to July 1, 1953, from the Tensleep was 14,752,857 bbl.

Gas withdrawals for the month of June averaged 10,271 M.c.f. comprised as follows: Frontier 3,271 M.c.f. (10 wells); Cloverly 361 M.c.f. (3 wells); Morrison 48 M.c.f. (1 well); and Embar 6,591 M.c.f. (3 wells).

Condensate production from the Embar reservoir averaged 307 bbl. per day during June 1953 and the cumulative recovery was 473,375 bbl. to July 1, 1953.

Big Sand Draw field is located in Township 32n, Range 95w, Fremont County, Wyoming. It is 20 miles southeast of Riverton in the southwest portion of the Wind River basin.

Structurally, Big Sand Draw is located along the crest of a long, narrow, asymmetrical anticline which trends N. 30° W. and parallels roughly larger mountain-type uplifts to the east and west. An arm of the Wind River basin, 20 miles in width, lies west of the anticline and between it and the Wind River Mountains uplift. Big Sand Draw and Crooks Gap anticlines may lie on the same line of folding. Axis of Big Sand Draw structure plunges northwestward under Tertiary cover into the Wind River basin en echelon to the Beaver Creek axis.

Big Sand Draw structure was discovered by surface geology. The discovery well uncovered the Frontier gas reservoir in 1918. Subsequently, gas discoveries were made in both the Cloverly and Morrison gas sands.

Reflection seismograph surveys were employed in mapping deeper horizons on the basis of which method major discoveries were made in both the Permian Embar or Phosphoria limestone and the Pennsylvanian Tensleep sandstone. Phosphoria gas-distillate reservoir was discovered on December 5, 1948, by Sinclair Oil & Gas Co. at No. 8 well, C NE NE 15-32n-95w. From a plugback depth of 7,226 ft., it tested at the rate of 2,970 M.c.f. per 24 hours with 197 bbl. of 55.4°-gravity distillate.

Tensleep oil reservoir was discovered on December 24, 1944, by Sinclair's 1 Well, SW NW NW 14-32n-95w, completed for an initial of 804 bbl. per day at total depth of 7,593 ft. in Tensleep topped at 7,285 ft.

Market outlet for the oil and condensate is by Sinclair Pipe Line Co. to the Sinclair refinery at Sinclair, Wyo. Natural-gas production is purchased and transported by Northern Utilities gathering system to Riverton, Wyo., for liquids extraction and thence by distribution line for domestic consumption and manufacturing establishments.

Drilling rigs employed in the Big Sand Draw field are Model 50's powered by two 225-hp. engines. Slush pump is a Model C-50 7¼ by 15-in. pump. Rig is mounted on a 132-ft. derrick on a 10-ft.-high substructure.

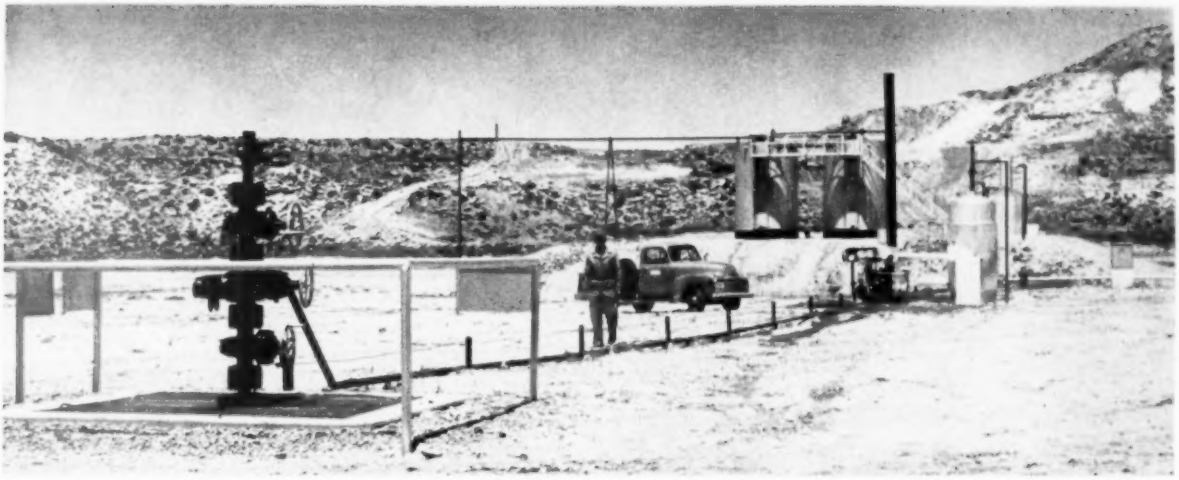
Signal Drilling Co. has a workover rig active in the field at this time.

Winkleman dome . . . Stanolind Oil & Gas Co., unit operator, plans to drill 10 additional company wells in Winkleman field in Fremont County during 1953. This has been one of the most prolific Embar-Tensleep fields in the Wind River basin and cumulative recovery to January 1, 1953, is 4,961,594 bbl. from nine wells. However, development during 1953 so far has boosted production from an average of 2,215 bbl. daily in 1952 to the present average of 4,085 bbl. daily from 15 wells.

Embar production is found at depths of from 2,500 to 2,850 ft. and Tensleep oil at depths of from 2,850 to 3,150 ft.

Winkleman dome is located in Township 2n, Range 1-2w, W.R.M. in the western part of the Wind River basin; it lies along the northeast flank of the Wind River Mountains. Structure is a topographic high of dissected outcrops of Mowry and Thermopolis (Cretaceous) formations surrounded by ridges of resistant sandstones of the Cretaceous Frontier formation. Surface structure shows 250 ft. of closure. Surface mapping shows four normal faults with displacements ranging up to 200 ft., but these die out at a shallow depth.

Drilling practices . . . Contractor cuts an 8¾-in. hole to the top of the Phosphoria formation where 7-in. pipe is set and cemented with 400 sacks of cement. Hole is reduced to 6⅛-in. and carried to total depth. About 15



THIS TENSLEEP OIL WELL in Beaver Creek oil field, Fremont County, Wyoming, in the Wind River basin produces from a depth of about 11,300 ft. Stanolind Oil & Gas Co. is unit operator in this field.

to 16 days are required to drill a 3,000-ft. test to the Embar.

R. L. Manning, Inc., Denver, operates a 4,000-ft. drilling rig for Stanolind at Winkleman. It is an Emsco PD36 powered by two Model 61 engines. Mud pumps are an FZ 6¾ by 14-in., and an FZ 5 by 14-in. with an independent drive on this No. 2 pump. Rig is equipped with a 96-ft. 437,000-lb.-capacity mast mounted on an 18-ft.-high substructure.

Beaver Creek field . . . This important natural-gas reserve lies on the southern rim of Wind River basin. Six gas wells, productive from the Cretaceous Frontier, Muddy, and Dakota-Lakota sandstone reservoirs, produced 20,355 M.M.c.f. of gas daily during first 6 months of this year; gas withdrawals vary from as low as 16 M.M.c.f. per day during the summer months to as high as 30 M.M.c.f. per day during the winter period.

The field furnishes about one-half of the fuel supply for domestic and industrial markets at Casper. With wide spacing of 640 acres per well, more than 3,840 acres has been proven for gas production on this 7-mile-long structure; productive limits have not been determined, except on the east steep flank.

Crude-oil production is obtained from 12 oil wells completed from the Cretaceous Mesaverde sand at 3,800 ft. and from the Pennsylvanian Tensleep at 11,300 ft. Oil production for the first 6 months of this year have averaged 1,613 bbl. of oil per day. Since first oil was produced in 1938, Beaver Creek has produced a total of 1,503,986 bbl. of oil to January 1, 1953. Stanolind is unit operator of this field.

In search of possible deeper oil and gas production, Stanolind is drilling a deep test to the Mississippian Madison on the crest of the structure at 30-M, NW NW 15-33n-96w. Currently, Loffland Brothers Co. is operating its Rig 72 for Stanolind here. It is a Model 125 rig powered by four LRO engines which also drive the two Model C-350 mud pumps. Rig is mounted on a 136-ft. steel derrick and a 14-ft. substructure.

Contractor cuts a 17¼-in. surface hole for the 13⅜-in. surface pipe; cement is circulated back of the pipe to the surface. Intermediate section is cut with a 12¼-in. bit in which a 9⅝-in. protection casing is set; cement is circulated back to the surface. Long hole is 8¾-in. for setting a 7-in. oil string through the pay objective; in this section, contractor carries twenty 6¼-in. drill collars to maintain a straight hole. Cretaceous shales are soft and cut easy; consequently difficulty is encountered in keeping the hole straight.

Beaver Creek is a gently folded anticline in the beds of the Wind River (Eocene) formation. About 100 ft. of closure is exhibited in the surface rocks. Several east-west-trending normal faults with a maximum vertical displacement of 160 ft. cut the fold at the south.

However, with depth, the major axis of this anticline changes to northwest-southeast to roughly parallel the southern margin of the Wind River basin. More than 1,200 ft. of structural closure has been mapped with total closure to be established.

Riverton dome . . . Ten miles to the northwest of Beaver Creek in Township 1s, Range 4e, W.R.M., lies Riverton dome on the same line of folding. Discovery well was completed by Atlantic Refining Co. during 1949, flowing 46°-gravity oil from the Pennsylvanian Tensleep sandstone found at 11,667 ft. Total gross pay section in the Tensleep was 110 ft. In 1951, a shallower oil pay was discovered in the Permian Phosphoria limestone at 11,587 ft., flowing 56°-gravity oil. Riverton dome produced 467 bbl. of oil per day from five Tensleep wells during April 1953.

Noble Drilling Co. is testing in the Tensleep sandstone at a developmental well on this structure for Atlantic, at 5 Tribal, C NE NE 36-1s-4e, W.R.M.

Steamboat Butte . . . This Wind River basin field has 40 producing oil wells with an April 1953 average of 10,607 bbl. per day. British-American Oil Producing Co. owns 36 of these wells with an average of 10,030 bbl. daily, while Brinkerhoff Drilling Co. and Sohio Petroleum Co. have 4 wells with a daily output of 577 bbl. Cumulative recovery to January 1, 1953, is 19,858,323 bbl.

This major asymmetric anticline lying on the west side of the Wind River basin lies on the same line of folding as Pilot Butte field. Steamboat Butte has a structural closure of 300 ft. on surface rocks.

Field discovery was made in 1943 by British-American E-1 Tribal, NE NW NW 5-3n-1w, W.R.M., which was completed for 623 bbl. of 30°-gravity oil from 5,094-5,109 ft. in the Jurassic Sundance sandstone.

Tensleep oil reservoir, the major producing horizon, was discovered in 1944 by same operator's C-2 Tribal, NE NE SE 31-4n-1w; it produced 570 bbl. of oil at 6,771-7,034 ft. Lakota oil production was discovered in December

1944 by E-4 Tribal, NE SE NW 5-3n-1w, with an initial output of 450 bbl. of oil per day at 4,495-4,544 ft.

Gravity range . . . Lakota produces a 38°-gravity oil with 0.1 per cent sulfur; Nugget sandstone 26°-gravity oil and 2.3 per cent sulfur; Phosphoria 31°-gravity oil and 1.5 per cent sulfur; and Tensleep 29°-gravity oil and 2.1 per cent sulfur.

Amsden gas production was discovered in 1946 by E-6 Tribal, NW NE NW 5-3n-1w, flowing 4 M.M.c.f. of gas per day from 7,325-51 ft.

Pressure Maintenance

Pressure maintenance by water injection into the Tensleep reservoir at North Steamboat Butte field, Fremont County, has been started by British-American Oil Producing Co. Objective sought is maintenance of high-fluid levels at presently contemplated higher withdrawal rates.

Benefits expected to accrue to lessor and lessee from maintenance of high fluid levels include (1) significant gains in crude-oil recovery by a more effective displacement of reservoir contents by injected water, and (2) more economical operation, due to low lifting costs.

A reasonably active water drive is now effective at low rates of oil withdrawal in the Tensleep sand reservoir. However, with the higher oil demand that will be in effect during the remainder of 1953 with the new pipe-line facilities of Platte, reservoir pressure declines at high withdrawal rates would be excessive with only the natural water drive available for pressure maintenance.

Therefore, British-American engineers concluded, after preliminary reservoir studies, that it would be economically feasible to inject water into the lower part of the Tensleep below the oil-water contact of this reservoir as a means of maintaining high fluid levels at higher withdrawal rates.

Plant construction, now under way, will employ chlorination of water for killing bacteria, and a filter to remove fine solids from the water. A water-supply well has been drilled into the gravel bed at Wind River and an 8-in. water supply line laid from this well to the plant location about 4 miles to the north. Injection lines have been installed from the plant location to Tribal C-6, R-1, and V-1 wells.

Pilot Butte . . . South of Steamboat Butte is a high-productivity Embar-Tensleep field, Pilot Butte, which has 26 oil wells completed in these formations with a daily average production of 1,484 bbl. for April 1953. In addition there are eight small Cody sand stripper wells. Cumulative oil recovery to July 1, 1953, is 5,135,418 bbl.

DEEP-DRILLING OPERATION in Beaver Creek oil field, Fremont County, Wyoming.

Pilot Butte is an irregular dome-shaped structure with a closure of 600 ft. developed in the Cretaceous Pierre shale. Numerous faults intersect the structure.

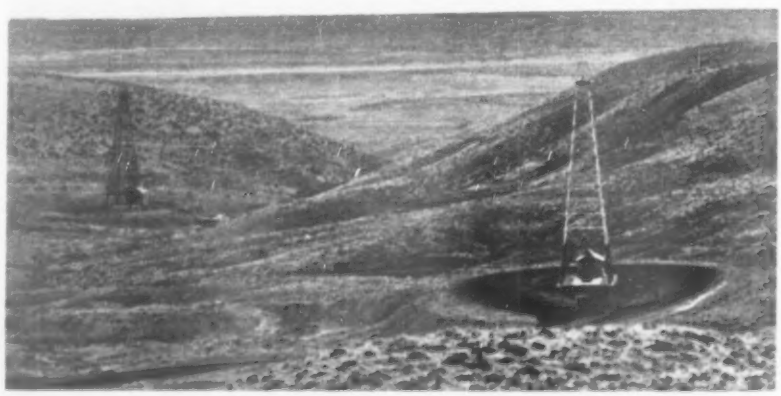
Field discovery was made in 1916 by Midwest Refining Co. and Standard Exploration Co. in NE NE NE 17-3n-1w, W.R.M., which was completed in the Steele-Niobrara shales at 1,255-1,306 ft.

Tensleep oil was first produced in 1942 when British-American and Superior Oil Co. of California completed 1 Tribal, SW SE SW 15-3n-1w, W.R.M., for 750 bbl. of 24.7°-gravity oil from 6,184-6,323 ft. Embar-Tensleep reservoir produces a 24°-gravity oil with a 2.3 per cent sulfur content.

Natural gas and gasoline . . . Northern Utilities Co., of Casper, operates a complete natural-gas system in the Wind River basin. Principal gas sources are from the Beaver Creek and Big Sand Draw fields. Properties of the firm include 313.5 miles of main transmission line, 115.02 miles of distribution line, compressor stations, a natural-gasoline absorption plant, dehydration plant, and a sulfur-removal unit.

Natural gas is distributed by this firm to domestic consumers, refiners, and other large industrial establishments in Casper, Evansville, Glenrock, Riverton, Mills, Hudson, Lander, and Rock Springs.

The firm purchases wet gas from Beaver Creek and Big Sand Draw fields and transports it northwest via a 6-in. gathering line to Riverton, where it operates a natural-gasoline plant with a daily capacity of 4,494 gal.



WINKLEMAN DOME is one of the most prolific Embar-Tensleep fields in the Wind River basin. Stanolind Oil & Gas Co. has produced about 5 million barrels of oil from 15 wells.

DRILLING SCENE in West Sussex field of Johnson County, Wyoming, on the southwest limb of the Powder River basin where Continental Oil Co. has 220 oil wells in this and adjoining multiple-zone fields.

POWDER RIVER . . .

Wyoming's Most Active Oil-Producing Basin

FIRST one area and then another has kept the Powder River basin of northeastern Wyoming the most active of the numerous Wyoming basins for the past few years.

This big basin offers many kinds of traps and numerous favorable sands throughout a large, sparsely tested area. Though Cretaceous sands have been the principal objectives in Powder River basin exploration drilling during its 60 years of history, pre-Cretaceous rocks have entered the picture in recent years.

The first discovery of oil in the Powder River basin was made in 1889 when, on the basis of seepages, a well was drilled just north of the Salt Creek structure. Following geologic studies, the structure itself was drilled in 1906. Salt Creek gave Wyoming its first and biggest oil boom and developed into the biggest oil field in the Rockies. Although the field's production has declined far below that of Rangely and Elk basin, Salt Creek is much larger than either of them when measured by estimated ultimate recovery. Salt Creek has produced 350 million barrels of oil and has an estimated remaining reserve of 50 million barrels.

After the discovery of Salt Creek, there were other surface-expressed anticlines on the basin's rims that were tested and found productive. Geophysics entered the plan and was credited with a discovery in 1938. Meanwhile, in 1920, oil was found at "structureless" Osage on the east side of the basin. After Osage, interest on the eastern side of the basin died until several big wells were completed at Mush Creek in 1947. During the next 3 years the spotty, stratigraphic trapped pool of the Mush Creek-Skull Creek and Fiddler Creek areas were rapidly developed. Interest has been rearoused in this eastern portion of the basin by recent discoveries in the Clareton area.

The development of discoveries in and between the Sussex-Meadow Creek and Glenrock areas, which began in 1949 as a fault-trap play but became primarily a search for proper sand conditions on the flanks of structures in some parts of this trend, has accounted for a large portion of the drilling activity in the Powder River basin during the past few years.

Last year the discovery of oil in the Cretaceous-Shannon at Ash Creek, 110 miles north of the Meadow Creek area gave new life to the search along the western edge of the Powder River basin and increased interest in the production-less northern sweep of the basin.

Geologic Sketch

The Powder River basin is bounded by pronounced positive tectonic elements except on the north where a dividing line between this basin and the Williston basin is without a definite topographic or structural break. On the east side of the basin is the Black Hills uplift, on the southeast the Hartville uplift, on the south the Laramie range, on the southwest the line of folding and faulting between the Laramie and Big Horn ranges, and on the west by the Big Horn Mountains.

The axis of the Powder River basin lies near the western side of the basin as mapped on a Cretaceous sandstone (see accompanying map of basin). The basin is a broad syncline with marginal zones of relatively steep folding and faulting but apparently with very low folding in its interior parts. It is estimated that the basin's sedimentary section is about 16,000 ft. thick.

Producing formations . . . Strata in the Powder River basin range in age from Middle Cambrian to Eocene. Lower Cambian, Silurian, and Devonian strata are absent in the basin and Middle Cambrian strata occur only in the western portion. Ordovician rocks are restricted to the northern portion of the basin.

The Powder River basin area contains some of the most important oil fields in the Rocky Mountains. Production is found in the Cretaceous (Sussex and Shannon sands of the Steele, Niobrara, Carlile, Frontier, Muddy, Dakota, and Lakota), Jurassic (Morrison and Sundance), and the Pennsylvanian (Tensleep).

Major Fields

(See accompanying table)

Producing fields in the Powder River basin are restricted to the rims of the basin. On the west and south sides of the basin the producing fields are on surface-expressed structures and in fault

traps and flanking sands related to these structures. On the east side of the basin, just to the west of the Black Hills uplift, oil is produced from structureless traps in ragged sandstones enclosed in an Upper Cretaceous marine shale. A deep noncommercial producing well drilled near the center of the basin at Adon indicates that pre-Cretaceous formations contain oil in those parts of the basin where there is little deformation.

Salt Creek . . . The biggest oil field ever found in the Rocky Mountains is Salt Creek. This giant field lies on the western rim of the Powder River basin on a tremendous and obvious anticline. There are five important reservoirs at Salt Creek, one on top the other: the first Wall Creek, the second Wall Creek, the Lakota, the third Sundance, and the Tensleep. The second Wall Creek is the most prolific reservoir, it being estimated to have contained two-thirds of the total oil in the field.

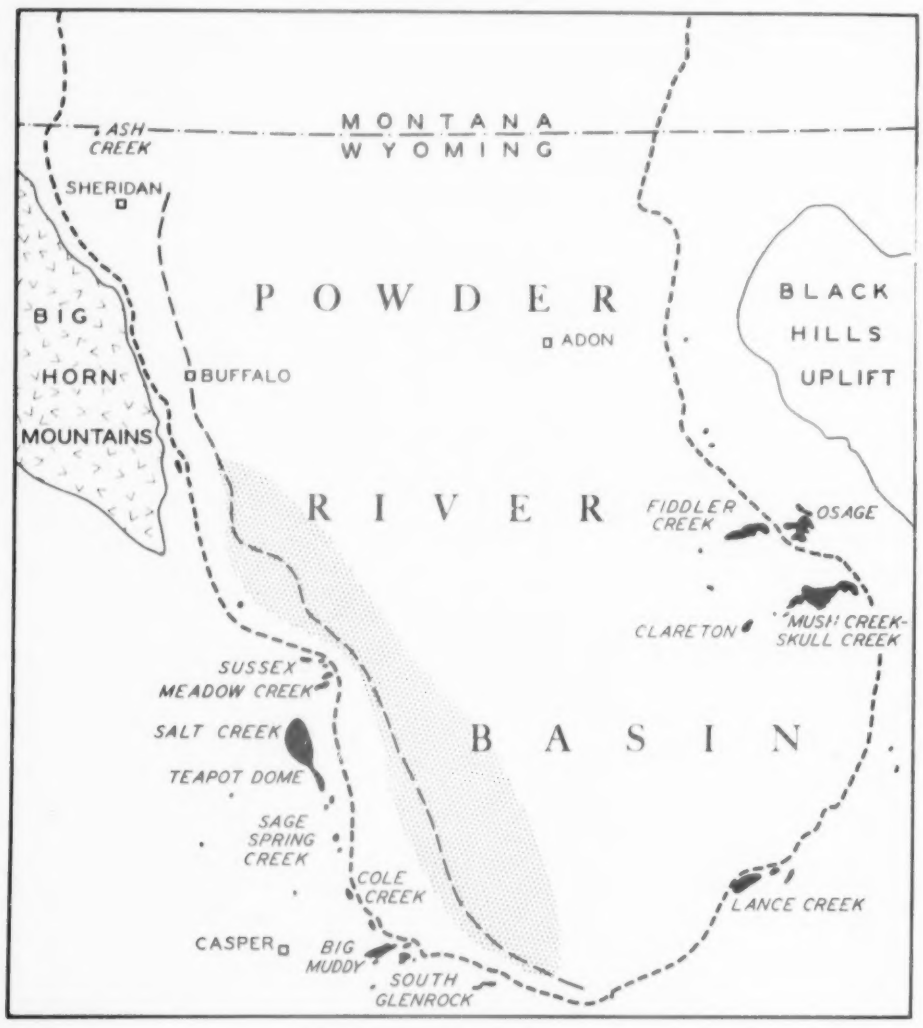
The Salt Creek anticline has approximately 1,600 ft. of closure. It is 15 miles long and 5 miles wide with a productive area of 22,000 acres. This field has produced more than 30 per cent of all the oil ever produced by the State of Wyoming. Salt Creek crude has extremely desirable characteristics.

Eastern margin fields . . . Production at Osage, Fiddler Creek, Mush Creek-Skull Creek, and Clareton area fields on the eastern side of the Powder River is obtained from a series of irregular, lenticular sands on structural terraces on the southwestward dipping Osage monocline. The accumulation of oil in the area of these fields is directly related to the changes in facies of Newcastle sands in contrast to the structural accumulations throughout most of the Rocky Mountain area.

Sussex-Meadow Creek . . . Located immediately to the north of Salt Creek are the Sussex-Meadow Creek fields. This has been the Powder River basin's most active development area in recent years.

Sussex field was discovered by a Lakota well completed in 1948. North Meadow Creek, which lies but a few miles to the southeast of Sussex and produces from the Sussex and Shannon sands, was discovered in 1949. On to the south, Meadow Creek field was discovered in 1950 by a Lakota well. In addition to the discovery formations these fields now produce from the Frontier, Sundance, and Tensleep sands.

The structures of the fields in the Sussex-Meadow Creek area are not expressed on the surface. The fields were found by drilling seismic highs on the Lakota, but development drilling has shown that the major oil accumulations of the area have no direct relationship to seismic features.



Drilling activity . . . A total of 37 active drilling rigs are now at work throughout 7 counties in this basin. Exploratory work, comprising 14 rigs, is concentrated in Johnson, Natrona, Niobrara, and Weston counties, with single rigs active in Converse, Crook, and Sheridan counties.

Development operations, totaling 23 rigs, are led by Weston County which has 12 units working on offsets. Converse County has five rigs active. Other work is scattered throughout Johnson, Natrona, and Niobrara counties.

Lance Creek . . . Surpassed in the Powder River basin only by Salt Creek, Lance Creek field has produced more than 90 million barrel of oil to July 1, 1953. This field in T. 55 and 56 N., R. 65 W., Niobrara County, Wyoming, occupies the west end of an anticlinal fold about 12 miles in length trending generally east-west.

Ohio Oil Co. discovered all producing formations in Lance Creek field. The first produc-

ing horizon was discovered in October 1918 when a well was completed for 80 bbl. of oil daily from the Wall Creek sand at a depth of 2,689 ft. The well was later deepened to the Dakota where it produced 1,500 bbl. of 38°-gravity oil per day. By 1930, about 120 wells had been completed in sands of the Cretaceous Dakota series.

Lance Creek and the adjacent east Lance Creek and Little Buck Creek fields are located on an elongated, sinuous, asymmetric anticline which is separated from the Hartville uplift by a shallow syncline.

This field, which played an important role in the early history of the petroleum industry in Wyoming, is still important today and much of the credit for this continued importance can be attributed to the unit development of some of the reservoirs.

First Sundance sand was found productive in 1930. In 1935, Basal Sundance sandstone production was found and a well completed with an initial production of 2,000 bbl. of 47°-gravity oil per day. In 1938, the majority of productive acreage in this reservoir was unitized.

Although the Basal Sundance Unit was not the first unit proposed in the Rocky Mountain region it was the first unit agreement in this area that proposed secondary recovery after unitization, and thus received the enthusiastic support of USGS. There is no single operator for the unit; each working interest operates its own properties.

Injection of gas and excess L.P.G. products did not completely maintain reservoir pressure, but the rate of pressure decline was substantially reduced. To date, over 36 billion cubic feet of gas has been injected into the Basal Sundance reservoir of which some 14 billion remain in the reservoir.

During the early summer of 1952, a pilot water flood of the Basal Sundance was started. It is still too early to report any conclusive results from this pilot flood.

In May 1936, 42°-A.P.I. gravity oil was discovered in the Converse sand of the upper Minnelusa formation. This reservoir was unitized in 1943.

In June 1937, 45°-A.P.I. gravity oil was discovered in the Leo sands of the lower Minnelusa formation. This formation was unitized during the summer of 1937. In the fall of 1949 high-volume centrifugal pumps were installed in seven producing wells. The installation of these pumps has proved very successful.

Three deep tests have been drilled at Lance Creek but failed to find commercial production in any of the formations below the Leo.

As of January 1, 1953, there was 1 well producing from the Dakota, 9 from the First Sundance, 43 from the Basal Sundance, 4 from the Converse, and 100 from the Leo sand. Present production from all formations averages about 4,200 bbl. of oil daily.

Major working interest owners in Lance Creek field are Ohio Oil Co., Continental Oil Co., Carter Oil Co., Cow Gulch Oil Co., A. B. Cobb, and Argo Oil Co.

South Cole Creek . . . This important oil-producing area in Converse County in the southern portion of Powder River basin has 34 producing wells with a daily average production of 5,276 bbl.

Cretaceous producing reservoirs are the Lakota sandstone found at depths ranging from 8,268 to 8,514 ft., and Dakota sandstone found at 8,309 to 8,737 ft.

Drilling and Production Data, Powder River Basin

Field and county—Producing name and formation age—	Year disc.	Type Str.*	Pay depth	Grav. oil, °A.P.I.	Wells: Flowing	Wells: Pumping	Wells: Total	Wells: Drlg.	Acres proved devel.	Oil production: B/D	Oil production: Cum. 7-1-53
WYOMING, OIL:											
Ash Creek, Sheridan—Shannon—Cretaceous sand	1952	A	4,798				10			1,142	176,933
Clareton, Weston — Newcastle — Cretaceous sand	1950	T	6,148	43.0			17	15		1,787	647,203
Cole Creek, Natrona—Shannon, Dakota, Lakota—Cretaceous sand	1938	A	4,500-7,950	36.0			41		1,652	1,789	6,266,964
Cole Creek South, Natrona—Muddy, Dakota, Lakota—Cretaceous sand	1948	A	8,300-8,350	36.0			34		730	5,276	3,528,211
Fiddler Creek, Weston — Newcastle — Cretaceous sand	1948	T		43.0			188	2	5,000	2,386	8,661,012
Glenrock, Converse—Muddy, Dakota—Cretaceous sand	1950	Af	7,020	40.0			99	1		11,223	6,642,958
Glenrock South, Converse—Muddy, Dakota—Cretaceous sand	1950	T	5,704	40.0				5			
Lance Creek, Niobrara—Dakota, Sundance, Morrison, Minnelusa—Cretaceous, Jurassic, Pennsylvanian, sand	1918	A	3,200-5,200	42-47			218	0	4,750	4,501	90,426,611
Meadow Creek, Johnson—Frontier, Shannon, Sussex, Dakota, Sundance, Tensleep—Cretaceous, Jurassic-Mississippian sand	1950	Tf	3,600-7,600	40.5			75	2		3,342	(See Sussex)
Meadow Creek North, Johnson — Sussex, Shannon—Cretaceous sand	1950	Tf	3,600	35.3-40.5			59	0	1,050	1,252	(See Sussex)
Mush Creek-Skull Creek, Weston—Newcastle—Cretaceous sand	1948	T	3,000	35.0			207	8	2,700	6,222	7,023,310
Osage, Weston—Belle Fourche, Newcastle—Cretaceous sand	1919	A		39.0			150		6,840	282	6,277,943
Salt Creek, Natrona—Frontier, Lakota, Amsden, Sundance, Morrison, Tensleep—Cretaceous, Jurassic, Pennsylvanian, sand	1906	A		26-37			1,161	4	21,450	11,375	346,104,679
Sussex, Johnson — Lakota, Shannon, Wall Creek, Tensleep—Cretaceous, Pennsylvanian, sand	1948	A		37.5-40.5			64	4	915	3,178	3,633,130
Sussex West, Johnson — Lakota, Shannon—Cretaceous sand	1952	Tf		40.0			16	2	5,000	1,384	231,577

*Legend: A—anticline; Af—faulted anticline; T—terrace; L—lenticular; Str—stratigraphic; M—monocline.

Phillips Petroleum Co. holds full interest in a 4,900-acre unit producing 3,300 bbl. of oil per day in this field. Within unit limits, Phillips has completed 10 Lakota and 17 Dakota oil wells.

Weston County . . . The general Clareton-South Clareton on the east limb of the Powder River basin commands renewed field interest. The area now produces more than 5 per cent of the Wyoming total production of about 220,000 bbl. per day.

Completions in Weston County so far this year include 64 oil wells with a combined initial production potential of 21,845 bbl. daily; this is an average of 341 bbl. per well per day.

SEISMIC OPERATIONS on a prospect in the Powder River basin, Wyoming.

Pressure maintenance . . . Water injection and controlled oil rates, augmenting a partial water drive, have increased recovery efficiency from the Shannon sand reservoir in Cole Creek field, Natrona and Converse counties, Wyoming.

Shannon sand reservoir, a low-relief elliptical structure at 4,575 ft., was discovered during 1940 and drilling continued through 1945 which proved up 1,620 acres with a net pay section of 17.5 ft. A total of 32 wells are productive from the Shannon with an over-all average of one well per 50 acres. Pegasus division of Socony-Vacuum Oil Co., Inc., is sole operator of this unitized operation.

It became evident during 1943 that natural water encroachment would not support reservoir pressure and oil rate at the desired level. Water injection was commenced on an experimental basis in February 1946. Currently six wells are employed at the periphery of the reservoir for injection; five of these were former oil wells. Injectivity indexes range up to 1.0 bbl. per psi. pressure increase. Since August 1950, the total injection rate averaged 1,100 bbl. daily.

Reservoir pressures, originally 1,650 psi. at a datum of 1,075 ft. above sea level, have declined to 800 to 850 psi. in which range pressure has been maintained since 1946.

Refining installations . . . Three important refineries are located at Casper, Wyo., at southern rim of the Powder River basin. These are operated by Standard Oil Co. (Ind.), The Texas Co., and Socony-Vacuum.

Standard Oil Co. (Ind.) operates a complete plant including distillation, cracking, asphalt, and lube-oil facilities. Crude-oil-charging capacity is 20,000 bbl. per stream day. It has 5,000 bbl. per day of vacuum-distillation facilities, 4,450 bbl. per day of cracking capacity, 2,500 bbl. per day of coking capacity.

Fluid-type catalytic cracking amounts to 8,750 bbl. per day capacity. Asphalt production may reach as much as 2,935 bbl. per day, of which 1,000 bbl. per day is straightrun, 250 bbl. per day oxidized type, and the remainder of 1,685 bbl. is by other processes.

Socony-Vacuum's Casper refinery has a crude-oil charging capacity of 20,300 bbl. per day. Catalytic cracking facilities of the Thermofor type can process 6,500 bbl. per day. Asphalt plant capacity is 705 bbl. per day.

The Thermofor catalytic cracking unit at the Casper refinery of Socony-Vacuum Oil was the first to be originally engineered to handle liquid as well as vapor feed to the reactor. Selection of a liquid-feed process was a plant economics matter to utilize a process which would convert a maximum range of gas oils to gasoline and other more valuable distillates. Innovations were made in the feed-preparation section which were utilized in later installations.

The Casper refinery was expanded and modernized in early 1949 by addition of the catalytic cracking unit, diversion of former thermal cracking facilities to expanded crude processing, and addition of auxiliary refining facilities. Sweet and sour Wyoming crudes are charged separately to two conventional two-stage atmospheric-vacuum-distillation units. Sweet, green crudes comprise mainly those from nearby Cole Creek, South Cole Creek, and Big Muddy fields, and average about 35° A.P.I. gravity. A pipe-line mix of nine or more sour crudes from North Central Wyoming, averaging 26° to 28° A.P.I. gravity, supplement refinery runs.

The two crude units produce conventional straightrun distillate fractions and recover heavy vacuum gas-oil fractions for catalytic feed stock. Crudes are reduced to 130-140 soft point asphalts, comprising about 7 per cent crude and 14-15 per cent sour-crude bottoms.

The Texas Co.'s 17,000-bbl.-capacity plant as Casper has crude-oil distillation, cracking, and asphalt production facilities. It has 1,000 bbl. per day of reforming capacity and 3,000 bbl. per day of coking capacity. Fluid catalytic cracking facilities total 6,000 bbl. per day. Asphalt production is rated at 1,000 bbl. per day by straightrun processes.

Natural-gasoline plants . . . Two major natural-gasoline plants are in operation in the Powder River basin with a combined liquid capacity (including LP gases) of 177,450 gal. per day.

Since 1931, Stanolind has operated a natural-gasoline plant at Salt Creek in Natrona County, Wyoming. This plant was originally placed in operation in 1918 by Midwest Refining Co. At the present time approximately 1,000 wells are connected to the plant. The plant's processing capacity is 25 M.M.c.f. of gas per day with a comparable liquid recovery of 93,000 gal. per day.

At Lance Creek, Continental Oil Co.'s natural-gasoline plant has a combined liquid capacity of 62,454 gal. per day; this includes 27,468 gal. of natural gasoline, 17,934 gal. of propane, and 17,052 gal. of butane.

Continental Oil Co. has under construction in Sussex field a $1,750,000 gasoline-recovery and gas-repressuring plant. The plant will be similar to Continental's installation at Lance Creek.

RIGGING-DOWN OPERATIONS in the northern end of the Denver-Julesburg basin. Crew is lowering mast after completing another Dakota sand oil well for Ohio Oil Co. in Cheyenne County, Nebraska.

DENVER-JULESBURG . . .

Rocky Mountain Area's Busiest Basin

THE lure of production at moderate depth, a comparatively low cost of exploratory work, and a favorable land-leasing situation, has made the Denver-Julesburg basin the most active in the Rocky Mountain area during the past few years.

Though oil was produced in this basin area as early as 1862 and a few oil fields have been developed along the western margin of the basin, there was only one oil field on the eastern flank of the Denver-Julesburg basin prior to 1949 when Ohio Oil Co. discovered oil in commercial quantities in Cheyenne County, Nebraska. This rank wildcat discovery was soon followed by numerous oil and gas discoveries through Southwest Nebraska and Northeast Colorado. Most of the discoveries are relatively small in areal extent and most occur along a north-northeast trend that is several townships wide and now about 125 miles long.

The low-relief structures characteristic of the Denver-Julesburg basin, which in many ways is more Mid-Continent than Rocky Mountain, are found by seismic surveying. Structure alone, however, is not the answer in this area (see accompanying geologic sketch). Production is still restricted to a minor portion of the basin area but wildcat drilling is continually extending the producing trend farther and farther southwest toward the deeper parts of the basin. Deeper-pool tests have also found oil below Cretaceous sands which have been the sole producers in the area until recent months.

Geologic Sketch

The Denver-Julesburg basin of northeastern Colorado and southeastern Wyoming, southwestern Nebraska, and the northwesternmost tip of Kansas, is about 360 miles long and about 200 miles wide at its greatest width. Though a Rocky Mountain basin by virtue of its location with respect to the Front Range of the Rockies, the Denver-Julesburg basin is of the Great Plains physiographic province.

The Denver-Julesburg basin is limited on the west by the Front Range and Laramie uplifts of the Rocky Mountains, on the northwest by the Hartville uplift, and on the north by the Black Hills uplift. Topographically, the basin has no other boundaries, but geologically it is bounded on the northeast by the Chadron arch (a northern extension of the Central Kansas uplift, and on the southeast by the Las Animas arch, a flexure which began forming in Pennsylvanian time and is well defined in exposed Cretaceous formations northward from the Sierre Grande uplift.

The Denver-Julesburg basin is asymmetric with a very gentle east flank and a very steep west flank where the rocks climb abruptly, almost vertically, onto or are overriden by the Front Range uplift. The axis of the basin passes approximately under Denver and Cheyenne. The location of the basin axis has led some geologists to call this sedimentary unit the Denver-Cheyenne basin. That name is certainly more descriptive than "Julesburg," which was given the area by the U. S. Geological Survey in 1928; or "Denver," which was given a portion of the area by the U.S.G.S. in 1898. However, when the basin came into prominence in 1949 the two known names were combined and appear destined to be used rather generally for a few more years at least.

Producing formations . . . Prior to Pennsylvanian time there was a north-east-southwest trending "high" cutting across the present location of the Julesburg basin which resulted in an area of no pre-Pennsylvanian rocks throughout most of the present basin. The basin began to form in early Pennsylvanian time, but it was not until Upper Cretaceous time that it became an area of considerable deposition.

Nearly all of the production in the Denver basin is from beds of Cretaceous age, chiefly the Dakota group series of sands. The younger Greenhorn has been found productive in one field and in recent months there have been two discoveries in the Permian-Lyons sand for the only non-Cretaceous producing wells in the basin.

Production appears to be along definite trends based on both structure and permeability changes. The trends roughly parallel the southeastern limit of the basin throughout most of their lengths, but at the north elbow sharply and may parallel the northeastern limits of the basin. Production is found on east-west trending structures and westward nosing structures which have proper sand conditions.

Production resume . . . A sharp increase in oil production in the Denver-Julesburg basin followed completion of the Platte pipe line during 1952. The increased outlet facilities, plus increased exploration and development activities in the basin this year, have boosted total production of the basin to nearly 35,000 bbl. daily. Colorado's portion has risen to a new high of almost 20,000 bbl. and southwestern Nebraska is about 13,000 bbl. daily—also a new record.

Commercial oil production was first discovered in the southwestern portion of the basin in Florence pool in Fremont County, Colorado, in 1863. Several other oil and gas pools of minor significance were found along the eastern Rocky Mountain front from 1863 to the early 1930's. It was not until the discovery of oil by Ohio Oil Co. in Cheyenne County, Nebraska, in 1949, that the basin came into its own importance.

Oil and gas pools discovered since 1949 extend east-west from Big Springs gas field in Deuel County, Nebraska, to Borie pool in Laramie County, Wyoming, a distance of 200 miles. In a north-south direction, they reach from Alden pool of Morrill County, Nebraska, to Rush-Willadel pool in Washington County, Colorado, a distance of more than 180 miles.

This area now contains 37 oil and 10 gas pools in Nebraska; 2 oil and no gas pools in Wyoming, and 46 oil and 14 gas pools in Colorado. Ohio Oil Co. owns, or has an interest in 20 oil and 9 gas pools in Nebraska, and 3 oil pools in Colorado with a daily production of in excess of 7,000 bbl. per day.

All production from the basin is from rocks of Cretaceous age with the exception of two recent Permian discoveries. One is the Keota pool of north-central Weld County and the other is Black Hollow pool in northwestern Weld County, Colorado.

Exploratory completions for the first 6½ months of 1953 total 153 for Colorado, 3 for Wyoming, and 80 for Nebraska. This exploratory effort has resulted in discovery of 12 oil and 4 gas pools in Nebraska, and 18 oil and 7 gas pools in Colorado.

Producing Fields

(See accompanying table)

Oil and gas fields of the Denver-Julesburg basin are numerous but most of them have very limited areal extent. In total, however, they are very significant. These fields account for most of the production in Nebraska and an ever-increasing portion of Colorado's production, which is still dominated by Rangely field.

The most prolific field in the basin is a 1952 discovery called Little Beaver. This field has rapidly climbed to third place in the producing fields of Colorado, ranking behind Rangely and Wilson Creek. Little Beaver is located near the southern end of the present producing trend in the Denver-Julesburg basin. It produces from to especially well-developed sands of the Dakota group.

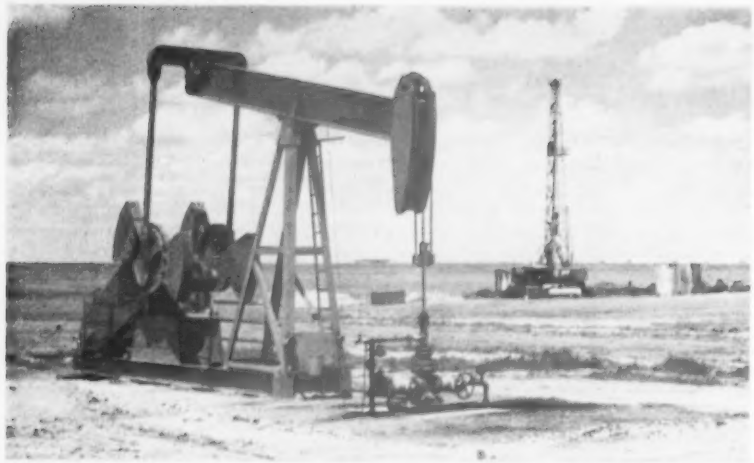
Greasewood . . . The first discovery of oil on the east flank of the Julesburg basin was Greasewood. The significance of this field lies not in its size, but due to the fact that it proved the existence of commercial oil on the east flank of the basin. It was not until nearly 20 years later, however, that another field on the east flank was opened.

Southeast Gurley . . . The discovery that started the recent activity surge in the Denver-Julesburg basin was located in what is now called Southeast Gurley

Drilling and Production Data, Denver-Julesburg Basin

Field and county—Producing name and formation age—	Year disc.	Type Str.*	Pay depth	Grav. oil, °A.P.I.	Wells: Flowing	Wells: Pumping	Wells: Total	Wells: Drlg.	Acres proved devel.	Oil production: B/D	Oil production: Cum. 7-1-53
COLORADO, OIL:											
Canon City and Florence, Fremont—Pierre—Cretaceous shale, sand	1863-76	M	1,000	31	0	27	27	0	9,000	73	14,130,875
Fort Collins, Larimer—Muddy, Dakota—Cretaceous sand	1924	A	4,300	35.2	8	0	8	0	520	90	2,495,623
Greasewood, Weld—Muddy, Dakota—Cretaceous sand	1930	Af	6,650	42	0	6	6	2	300	134	858,016
Keota, Weld — Dakota-Graneros J — Cretaceous sand	1952	A	7,340	39			17	1	520	824	377,373
Little Beaver, Washington—Dakota-Graneros D — Cretaceous sand	1952	A	5,388	40			35	9	2,080	2,147	491,487
Luft, Logan — Dakota-Graneros D — Cretaceous sand	1952	T	5,026	40			26	4	760	1,599	318,473
Merino, Logan — Dakota-Graneros — Cretaceous sand	1950	A	5,087	39			18	1	760	1,203	1,128,861
Mount Hope, Logan — Dakota-Graneros — Cretaceous sand	1950	A	4,866	40.5			54	1	2,160	3,962	1,351,833
Padroni West, Logan—Muddy, Dakota—Cretaceous sand	1952	A	4,860	17-39			7	0	200	168	79,859
Wellington, Larimer—Dakota-Graneros—Cretaceous sand	1923	A	4,210	37.4			11	0	1,920	88	5,774,733
Yenter, Logan—Dakota-Graneros D, J, M—Cretaceous sand	1950	A	5,245	38			61	3	1,680	3,138	1,727,879
NEBRASKA, OIL:											
Cook, Cheyenne—Dakota—Cretaceous sand	4-52	A	4,357	37			9	1	160	1,086	255,502
Doran, Cheyenne — Dakota D — Cretaceous	4-53	A	4,784				9	2	180	600	23,360
Dorman, Cheyenne — Dakota — Cretaceous	7-50	A		35			15	1	360	1,039	863,377
Huntsman, Cheyenne — Dakota — Cretaceous	1-50	A		35			14	0	370	817	1,156,656
Gurley, Cheyenne—Dakota—Cretaceous sand	6-49	Af		35			23	0	620	1,571	1,400,278
Johnson, Cheyenne—Dakota First, Third—Cretaceous sand	5-51	A	4,584	37			10	0	120	888	303,126
Kugler, Cheyenne—Dakota—Cretaceous sand	1-52	A	4,527	37			7	0	140	802	223,626
Nichols, Cheyenne—Dakota D—Cretaceous	1953	A	5,027				4	2	100		18,613
Potter Southwest, Cheyenne—Dakota—Cretaceous sand	1951	A					32	5	560	683	449,621
Reimers, Cheyenne — Dakota Third — Cretaceous sand	7-51	A	4,831	37			6	0	120	641	245,850
Sidney North, Cheyenne — Dakota — Cretaceous sand	12-51	A		37			6	1	160	626	162,217
WYOMING, OIL:											
Borie, Laramie—Muddy—Cretaceous sand	8-49	A	8,700	38.4			6	1	400	714	606,148
Horse Creek, Laramie—Muddy, Lakota—Cretaceous sand	1942	A	5,300-5,450	31-35		32	32	0	1,900	743	2,547,371
COLORADO, GAS:											
Akron West, Washington—Dakota J—Cretaceous sand	1952	A	5,169		1		1	0	640		
Armstrong, Logan — Dakota D — Cretaceous	1950	A	5,240		4		4	0	1,280		‡148
Frenchman's Creek, Logan—Dakota J—Cretaceous sand	1952	A	4,790		1		1	1	640		
Peetz North, Logan—Dakota D—Cretaceous	1952	A	5,140		1		1	0	640		
Peetz West, Logan—Dakota D—Cretaceous	1952	A	5,150		‡12		‡12	0	950		
Stoneham, Weld—Dakota J—Cretaceous sand	1952	A	5,891		1		1	0	640		
Yenter, Logan—Dakota D—Cretaceous sand	1951	A	5,150		‡6		‡6	0	420		
NEBRASKA, GAS:											
Big Springs, Deuel—Dakota D—Cretaceous	9-50	A	3,300		15		15	0	7,385		‡2,949
Huntsman, Cheyenne—Dakota J—Cretaceous	1-50	A	4,700		7		7	0	5,760		‡4,809
Marlow, Cheyenne—Dakota D, J—Cretaceous	4-51	A	4,710		3		3	0	1,920		
Peetz N. W., Cheyenne—Dakota J—Cretaceous sand	1952	A	5,435		1		1	0	640		
Sidney S. E., Cheyenne—Dakota J—Cretaceous sand	1952	A	5,140		1		1	0	640		
Sidney S. W., Cheyenne—Dakota D, J—Cretaceous sand	11-50	A	4,840		5		5	0	14,720		
Sidney West, Cheyenne—Dakota D, J—Cretaceous sand	1952	A	4,810-4,953		4		4	0	2,560		
Sunol, Cheyenne — Dakota D — Cretaceous	1950	A	4,350		1		1	0	640		

*Legend: A—anticline; Af—faulted anticline; T—terrace; L—lenticular; Str—stratigraphic; M—monocline. ‡Million cubic feet. ‡Includes reserves behind pipe.



PUMPING UNITS IN THE DENVER-JULESBURG BASIN . . . View at left shows typical unit on a 5,000-ft. Dakota sand completion in Cheyenne County, Nebraska. Photograph at right shows a unit on a 6,700-ft. Dakota "D" sand well in Buckingham field, Weld County, Colorado, in the deeper part of the basin.

field. The rank wildcat discovery completed by Ohio Oil Co. in 1949, initialed 230 bbl. of oil from a Dakota sand at about 4,400 ft. Though there was no water produced by the discovery well about half of the subsequent wells in this field had water cuts varying up to 35 per cent.

The Southeast Gurley structure, found by seismic work, trends east-west and is cut by faults which start in the Niobrara and die out before the producing Dakota sands are reached. The structure has more than 100 ft. of independent closure.

West flank fields . . . The oldest field in the Rocky Mountain area is Florence field in the Canon City embayment at the southwestern corner of the Julesburg basin. This field produces from fractured zones in the lower portion of the Pierre shale. Boulder, the flank's second discovery, also produces from fractured shale. Wellington field is characteristic of those few old fields located on the west flank of the Julesburg basin. The field is on an anticline with a closure of at least 1,000 ft., and like Fort Collins and Berthoud, produces from sand (so-called Muddy).

Drilling Activity

A total of 55 operating rigs are drilling at this writing in the three-state Denver - Julesburg basin comprising northeastern Colorado, southwestern Colorado, and southeastern Wyoming.

Exploratory drilling is being conducted by 17 of these rigs. In northeastern Colorado, 13 exploratory rigs are working. Weld County leads with seven followed by Logan with four, and Adams, Morgan, and Washington with one each. On the Nebraska side of the basin, three rigs are working on exploratory tests in Banner, Cheyenne, and Kimball counties. In Laramie County, southeastern Wyoming, a wildcat is active in the Pine Bluffs area.

Development drilling is likewise paced by the activity in northeastern Colorado where there are 14 rigs active principally on "J" sand reservoir offsets. Principal activity lies in Adams and Washington counties where there are four rigs each, and in Logan where three rigs are in operation. Weld has two and Morgan one rig active.

In southwest Nebraska, Kimball has three rigs and Cheyenne two. A single rig is working on development operations in the Borie field of Laramie County, Wyoming.

Producing reservoirs . . . Producing sands are found principally in the "D" and "G" sands in the Graneros-Dakota series of Upper Cretaceous age and in the "J" sand of Lower Cretaceous age. Depth to production ranges from as shallow as 3,500 ft. on the east edge of the basin to more than 8,400 ft. in Borie field on the steeply dipping west limb of the basin.

Occurrence of oil and gas accumulations in the Denver-Julesburg basin is not directly related to large closures; many fields are situated on terraces. Considerable faulting of low order of magnitude, i.e. 40 to 210 ft. in vertical displacement, characterizes the structure of the Cretaceous section on the east limb of the basin, particularly in the Huntsman area of Cheyenne County, Nebraska.

Seismic exploration . . . Prior to 1942, considerable seismic work was conducted in covered portions of the basin without favorable results. The first seismic discovery was made during 1943 when Horse Creek field, northwest of Cheyenne, was discovered. This successful find proved the ability of the seismograph to discern buried subsurface structures beneath the thick Tertiary cover.

The same year, Ohio Oil Co. commenced a broad reflection seismic exploratory program commencing at the Wyoming-Colorado line and extending eastward into Logan and Washington counties in northeastern Colorado. In the spring of 1946, this firm stepped up its seismic program northward into the counties of Deuel, Cheyenne, Garden, and Morrill in southwestern Nebraska. Since 1949, when Gurley field was discovered, Ohio Oil has developed a number of important oil and gas fields in Cheyenne and Deuel counties.

Low-displacement faulting in and immediately above Graneros - Dakota series (main producing reservoirs) can be resolved only by continuous profiling. Faulting affects local accumulations of oil and gas. Regional tectontic tilting has altered original relationship of accumulations of hydrocarbons to structure. Moreover, the highly lenticular character of the Graneros-Dakota sands complicates the character of reflections.

The thick Tertiary cover and Quarternary mantle with sand-dune and badland topography in places introduces problems in shot-hole drilling, equipment mobility, and near-surface corrections. Rejuvenated topography in places involves corrections including complex weathering conditions and rapid variations in surface elevations.

The relatively low relief of subsur-

face structures of the Denver-Julesburg basin accentuates the critical character of near-surface corrections. The amount of closure lies almost within limits of error of the seismic method. In addition, variety of topography and surface materials introduce a major problem in selection of proper correction method for a given sector.

Seismograph-interpretation problems concern mainly the interval from the top of the Niobrara to the Graneros-Dakota; faulting, sedimentation, and frequency anomalies complicate seismic records in this interval.

HUNTSMAN GASOLINE PLANT of Ohio Oil Co. in Huntsman field, Cheyenne County, Nebraska, has been in operation since February 1951.

Colorado Fields

Drilling Practices

Net drilling progress days vary from 5.5 to 9 per well in the Fort Morgan area to a depth of 5,000 ft. In the Greasewood area of eastern Weld County, the net days vary from 12 to 15.

Drilling weights carried throughout this interval are in the order of 4 tons. However, weights as high as 15 tons have been carried in the lower section from the top of the Niobrara formation.

Rotary-table speeds vary from 125 to 225 r.p.m. in the upper part of the hole; but in the lower portion of the well bore, the table is turned at lower speeds ranging from 60 to 150 r.p.m.

Bore-hole sizes vary from 7⅞ to 9 in. Bits required for a 5,000-ft. hole vary from 4 to 9; for an average depth of 6,500 ft., this range is from 13 to 24.

Due to the low structural dips found on the east limb of the Denver-Julesburg basin and the light drilling weights employed, no serious deviation problem has been encountered.

Active drilling areas . . . Rig concentrations in the Denver-Julesburg basin feature Little Beaver field, Washington County, Colorado, Badger Creek, Adams County, Colorado, Keota field, Weld County, Colorado.

In Little Beaver field, completions are made in the "D" and "J" sands. General practice is to set the 10¾-in. surface casing at about 100 ft. and the long string of 7-in. pipe at depths ranging from 5,255 to 5,444 ft. Lohmann-Johnson Drilling Co. had a 5,193-ft. "D" sand completion in only 11 days at Continental Oil Co. 2 W. L. Downing, SW SE NE 32-1s-56w. It was spudded on June 20, 1953, and rig was released on July 1, 1953. After the long string is set and cemented, rotary is moved off and cable-tool unit moved in for completion. Perforating practice is six shots per foot opposite the "D" sand.

Operators active in Badger Creek field include Sinclair Oil & Gas Co. and Forest Oil Corp. In the South Badger Creek area, Globe Oil & Refining Co., Sinclair, and Triangle "J" Oil Co. are among the principal operators.

Five units working for Sinclair in Badger Creek field are operated by Falcon Seaboard Drilling Co., George G. Johnson, and Jet Drilling Co., generally on 5,400-ft. contracts. Falcon Seaboard operates a Model 350 rig and an N-7 in this field, Johnson has a U-15 draw works, while Jet has a Model 350 rig and a U-15 rig.

In one of the newest fields developed in the Denver-Julesburg basin, Sinclair has six completed "First" sand oil wells in the Graneros-Dakota; currently five wells are drilling for this some objective. Well-spacing practice is 20 acres per well. Average calculated initial production was 205 bbl. per well per 24-hour-period.

Keota field in Weld County, Colorado, has 17 oil wells on production from the "J" sand found at about 7,280 ft. Principal operators are Sherrod & Apperson, Tulsa, Continental Oil Co., Wycolo, and Johnson.

Approximately 800 acres has been proven productive to date on 40-acre development in this reservoir.

Nebraska Fields

First natural gas from Nebraska fields in the northern portion of the Denver-Julesburg basin was produced during 1951; a total of 3,677 M.M.c.f. was produced during that year. Gas withdrawals rose the following year to 5,287 M.M.c.f. and the following table presents an analysis by counties for 1952.

County	Annual output M.M.c.f.
Cheyenne	3,252
Deuel	1,994
Kimball	40
Banner	1
Total	5,287

West Sidney . . . One of the important gas fields under development in southwestern Nebraska is the West Sidney area of Cheyenne County, productive from the "D" and "J" sands of the Dakota-Graneros series. The following wells are significant:

Ohio Oil Co. 1 Witters, NE NE SE 18-13n-50w, flowed 7.5 M.M.c.f. of gas per day from 4,840-60 ft., discovered the "D" sand.

Ohio Oil Co. 1 Spicknal, NW NW NE 10-13n-50w, flowed 10.8 M.M.c.f. of gas per day from 4,753-75 ft. to open the "J" sand.

Ohio Oil Co. 1 Chambers, NW SE SE 14-13n-51w, flowed 3.5 M.M.c.f. of gas per day from 4,869-76 ft. to extend production in the "D" sand gas reservoir.

Refineries . . . Denver-Julesburg basin represents refining capacity of 37,806 bbl. per stream day from eight refineries. Nearly two-thirds is in the Denver area.

Largest of five refineries at Denver is Bay Petroleum Corp., 12,000 bbl. per day. Vacuum distillation facilities total 5,000 bbl. per day, thermal operations include 1,900 bbl. cracking capacity and 3,000 bbl. vis-breaking. Fluid catalytic cracking capacity is 3,500 bbl. per day.

Continental Oil's Denver refinery has a crude capacity of 9,556 bbl. per day, 2,000 bbl. thermal cracking, and 3,333 bbl. Thermofor. Cat poly production is 417 bbl. per day.

One of the most complete and largest capacity plants is Frontier Refining Co.'s plant at Cheyenne. Crude-charging capacity is 13,000 bbl. per day, vacuum distillation 2,500 bbl., thermal cracking 3,875 bbl., and fluid cat 6,500 bbl. Cat poly production is 950 bbl. daily. Straightrun asphalt output is 1,250 bbl. per day.

GREEN RIVER . . .

Wyoming's Most Promising Basin For Big Gas Reserves

THE Green River basin is being played heavily with the thought that here is a coming rival of the gas-producing San Juan basin of Northwest New Mexico, despite rather limited positive indications of its potentialities.

Production in the big Green River basin is widely scattered. There is a small amount of oil and gas produced on the extreme western edge of the basin, gas-distillate produced from 12,000 ft. near the center of the western portion of the basin, gas produced from fields located on the basin's central uplift, and oil and gas produced from small fields in the south-central portion of the basin near the Colorado-Wyoming line.

Pre-Tertiary rocks in the Green River basin area are found at depths of 5,000 ft. or more except on the broad, gently dipping flanks of the Rock Springs uplift near the center of the basin and on the very rims of the basin. There are, however, sizable areas within this province where proved oil and gas-producing rocks of Tertiary and Upper Cretaceous age can be tapped at moderate depths. It is in these areas that interest is high and exciting developments can be expected within the next few years.

The thickness and steep dips of the rock section near the mountains bordering the Green River basin is illustrated by Superior Oil Co.'s 20,521-ft. hole which, though only 10 miles from exposed pre-Cambrian granite, was still in Upper Cretaceous at total depth.

Geologic Sketch

The Green River basin is a structural and topographic basin in southwestern Wyoming. It is bounded on the east by the Rawlins uplift and the Sierra Madre Mountains, on the south by the overthrust Uinta Mountains and their southeastward extension, on the west by the rugged zone of folding and overthrusting known as the Wyoming-Idaho-Utah overthrust belt, on the north and northeast by the northwest-southeast trending Wind River Mountains and the east-west trending Sweetwater uplift.

The Green River basin is often divided into subsidiary basins. When this is the case, the name Green River is restricted to the northwest portion of the basin or, if the name Bridger basin is not applied to the southwest portion of the basin, to the entire area west of the Rock Springs uplift. The subsidiary basin within an outward facing escarpment of the Green River formation to the east of the Rock Springs uplift, is called the Washakie basin. The northwest portion of the greater Green River basin is known as the Red Desert basin.

The Rock Springs uplift, a north-south trending anticline which rises up near the center of the sedimentary unit, is the biggest single structure in the Rocky Mountains. Because of its location in the center of the intermontane area the thickest sedimentary sections of the Green River basin are found near the bordering uplifts. North and east of the Rock Springs uplift the Cretaceous and Tertiary rocks make up most of the great thickness of sediments. To the southwest of the uplift there is a pronounced thickening of the Paleozoic rocks.

Because of the great thickness of sediments throughout much of the Green River basin very little is known of the pre-Mesozoic rocks except from wells on the Rock Springs uplift and outcrops along the margins of the basin. The Eocene rocks which blanket most of the basin are nearly flay lying. Paleozoic rocks are found thrust over the Mesozoics along the western limit of the basin and along the southern boundary at the Uinta Mountains.

Producing formations . . . Sediments in the Green River basin range in age from Eocene through Cambrian. It is believed that there is in excess of 30,000 ft. of sedimentary rocks near the margins of the basin. Gas and gas-distillate production has been found in the Cretaceous (Lance, Frontier, Dakota, Lakota), the Triassic (Morrison), and the Jurassic (Nugget). Oil and gas have been found in the Eocene, Paleocene, uppermost Cretaceous (Hilliard), Cretaceous Mesaverde), and Jurassic (Nugget). At North Baxter Basin field some carbon dioxide gas was found in the Pennsylvanian (Tensleep) and an excellent oil show was encountered in the Tensleep by a wildcat in the southeastern portion of the basin.

Geophysical activity . . . Search for deep-seated structures in the Green River basin employed appreciable gravimeter work during 1952. Carter Oil Co. and Sohio Petroleum Co. both were active throughout Sweetwater County.

Important seismic work was conducted last year in the basin by The California Co., Carter, Cities Service Oil Co., Continental Oil Co., Ohio Oil Co., Phillips Petroleum Co., Seaboard Oil Co., Shell Oil Co. and others.

Producing Fields

(See accompanying table)

So far there are but few fields in the Green River basin and most of these produce gas or gas-distillate.

Baxter Basin . . . The gas fields on the 90-mile-long, 12-mile-wide Rock Springs uplift, which lies near the center of the Green River basin, are called North Baxter Basin, Middle Baxter Basin, and South Baxter Basin.

The discovery well of South Baxter Basin was completed in 1922. It flowed 36 M.M.c.f. of sour gas daily from a Dakota sandstone. Sweet gas was discovered in the Frontier in 1924. North Baxter Basin was discovered in 1926 by a Dakota gas well. In 1929, gas was found in the Morrison and in 1945 in the Nugget. In 1938, Frontier gas was found at Middle Baxter Basin and the following year at this field in the Dakota. Noncombustible gas (chiefly carbon dioxide) was tested by a well which went to the Weber in 1946.

Church Buttes . . . Credit for the discovery of Church Buttes field goes entirely to the seismograph. The big structure on which this field is located is completely masked by a thick Tertiary cover.

Church Buttes was discovered in 1946. It produces gas-distillate from the Dakota at a depth of 12,500 ft. The field is on a closed structure superimposed on a southward plunging anticlinal trend that roughly parallels the Rock Springs uplift. Independent closure of the structure is more than 300 ft. Wells at Church Buttes flow at rates up to 30 M.M.c.f.

Permian Basin
134 Central Building
Midland, Texas

Rocky Mountain States
Room 103, 120 N. 29th
Billings, Montana

Illinois Basin
707 Parrish Avenue
Owensboro, Kentucky

DISTRICT OFFICES

Kansas
108 Koch Building
Wichita, Kansas

Southeastern U.S.A.
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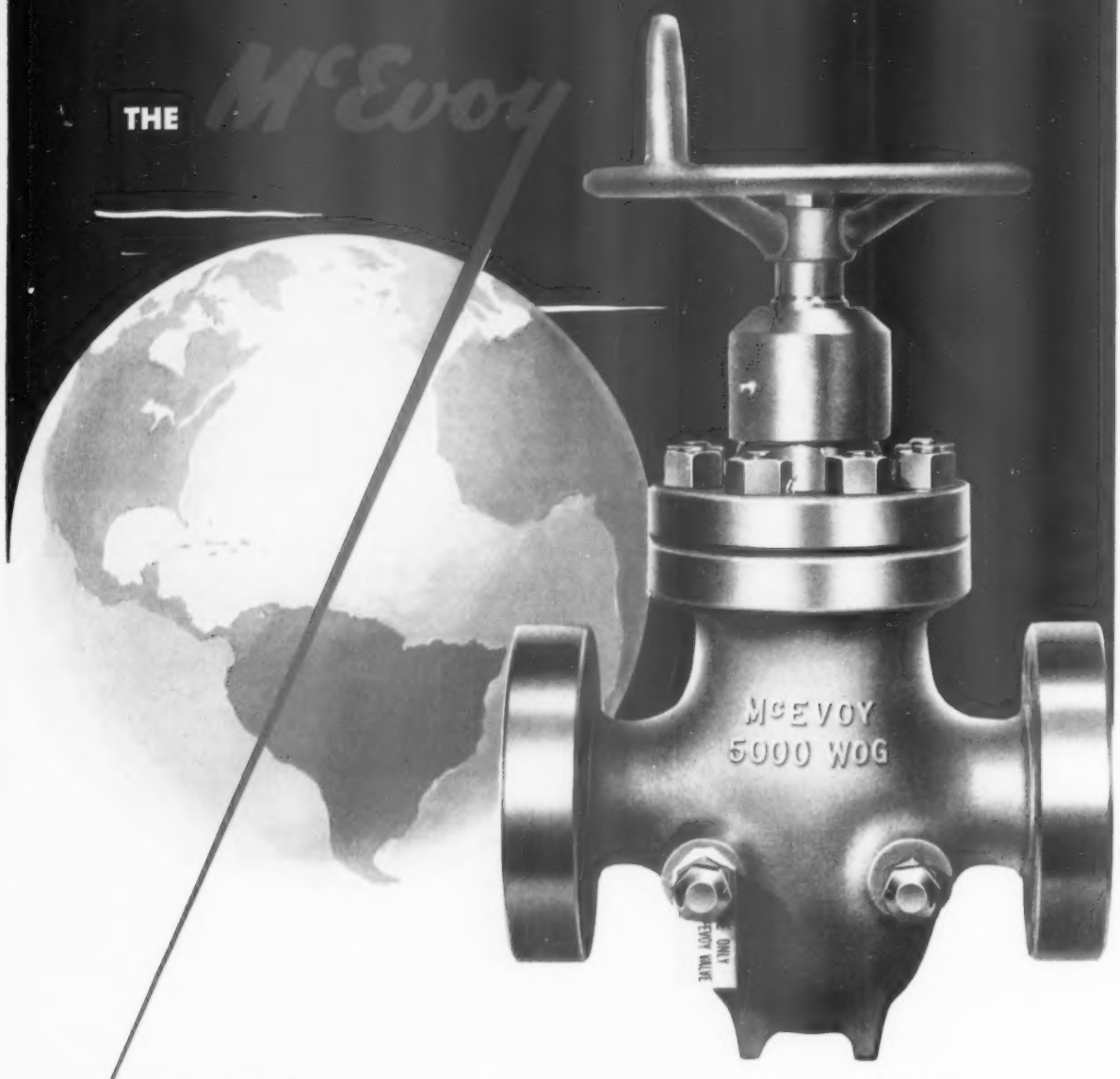

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daily through ½-in. choke on initial tests and have a shutin pressure of nearly 5,500 psi. Gas from this field is piped to the Great Salt Lake Valley after liquid hydrocarbons and water vapor have been removed by a dehydration plant at the field.

Hiawatha . . . Gas was discovered at Hiawatha field in 1926 by a well in Moffat County, Colorado. This discovery well had an initial flow at the rate of 45 M.M.c.f. daily from the Wasatch formation. The field is on a dome which has about 235 ft. of closure. Proved area of the field is about 4,400 acres with 3,700 in Colorado and 700 in Wyoming.

Recent discoveries . . . Last fall Stanolind Oil & Gas Co. completed a wildcat in the Mesaverde at 6,500 ft. for 169 bbl. of oil daily at Middle Mountain. A confirmation test about ½ mile southwest of the discovery is now being drilled.

To the northwest, at Trail, Mountain Fuel Supply Co. completed a Mesaverde gas well for 4,260 M.c.f. daily at 7,350 ft. Down along the Wyoming-Colorado line, where oil and gas are produced from lenticular sands in the lower Eocene for many years, Mountain Fuel completed an 11-M.M.c.f. gas well at Hiawatha from the Lance at 4,900 ft. At Powder Wash the same company completed a small Fort Union gas discovery.

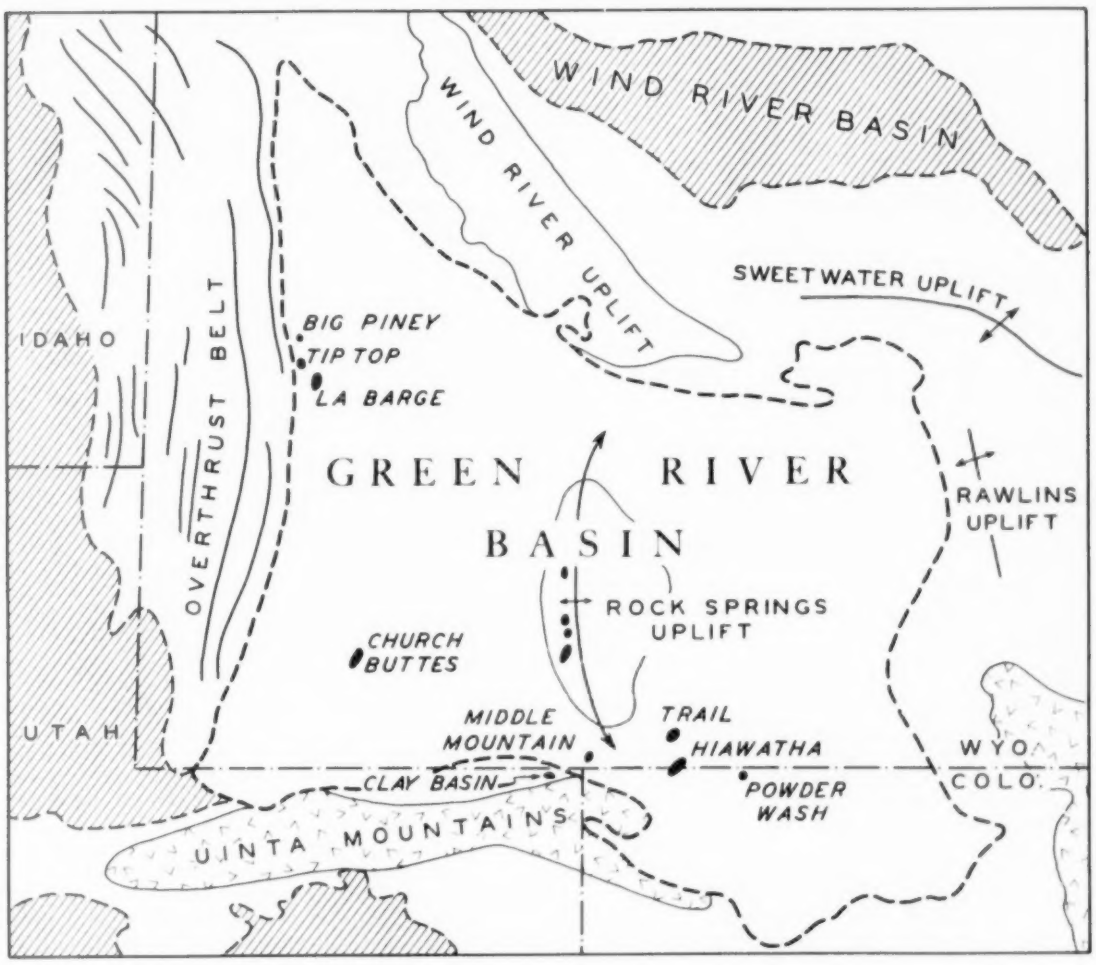
Tip Top field, on the extreme western margin of the basin, produces from the Nugget sandstone. There are two producing wells in this 1951 discovery. The first was completed for a flow of 266 bbl. daily and the second for a pumping gage of 450 bbl. of oil daily. The oil is 59°-gravity and has a paraffin base.

Lost Soldier field . . . One of the most prolific oil and gas fields in southwestern Wyoming in recovery from a multiplicity of pay zones is Lost Soldier field of Sweetwater County. This field lies 35 miles north-northwest of Rawlins.

Lost Soldier is an asymmetric anticline trending about N. 25° W., representing a major fold along the northern rim of the Great Divide basin. Proven producing closure on the Tensleep approximates 2,180 ft. Steep dips are found along the eastern flank. Small normal faults occur throughout the structure. Deeper horizons below the Permian Embar are highly shattered and fractured and this is an important reservoir factor in the fairly tight Tensleep, Darwin, Madison, and Cambrian formations.

First oil was discovered in Lost Soldier field on July 29, 1916, by Bair Oil Co. in 1 Lost Soldier, in NW 11-26n-90w, for an initial production of 200 bbl. per day from First Frontier sand found at a depth of 269 ft. From this horizon, 35 wells have been completed.

A few years later oil was discovered in the Dakota and Lakota sands and



Drilling and Production Data, Green River Basin

Field and county—Producing name and formation age—	Year disc.	Type Str.*	Pay depth	Grav. oil, °A.P.I.	Wells: Flowing	Wells: Pumping	Wells: Total	Wells: Drlg.	Acres proved devel.	Oil production: B/D	Oil production: Cum. 7-1-53
WYOMING, OIL:											
La Barge, Sublette, Lincoln — Wasatch — Eocene sand	1924	Af	650	34	0	140	140	0	950	941	12,862,406
La Barge North, Sublette—Adaville—Eocene sand	1931	Af	1,980	34	0	15	15	0	760	107	447,003
Middle Mountain — Mesaverde — Cretaceous sand	1952	A	6,545	49	1	0	1	1	80	1	
Tip Top, Sublette—Nugget—Cretaceous sand	1951	Af	9,682	60	0	1	1	1	40	68	73,555
COLORADO, OIL:											
Hiawatha, Moffat—Wasatch—Eocene sand	1926	A	1,992	38			15	0	600	206	1,434,000
Powder Wash, Moffat — Wasatch — Eocene sand	1936	A	5,360	38-48	8	0	8	1	320	713	978,688
WYOMING, GAS:											
Baxter Basin North, Sweetwater — Frontier, Dakota, Lakota—Cretaceous sand	1926	Af	3,000-4,000		10	0	10	0	1,500		
Baxter Basin Middle, Sweetwater—Frontier, Dakota, Lakota—Cretaceous sand	1938	Af	1,900-2,700		7	0	7	0	2,700		
Baxter Basin South, Sweetwater—Frontier, Dakota—Cretaceous sand	1922	Af	2,345-3,080		18	0	18	0	7,000		
Church Buttes, Sweetwater, Uinta—Dakota—Cretaceous sand	1946	A	12,550		9	0	9	0	4,800		
Hiawatha, Sweetwater — Wasatch — Eocene sand	1928	A	2,240		8	0	8	0	2,000		
Mahoney, Carbon—Dakota, Sundance—Cretaceous sand	1925	A	2,490-2,575		3	0	3	0	1,600		
Salt Wells, Sweetwater—Dakota—Cretaceous sand	11-49	A	6,262		1	0	1	0	640		
Trail, Sweetwater — Mesaverde — Cretaceous sand	1952	A	7,530		1	0	1	0	640		
UTAH, GAS:											
Clay Basin, Duggett—Frontier, Dakota—Cretaceous sands	1927	A	5,395-5,603		10	0	10	0	4,240		†77

*Legend: A—anticline; Af—faulted anticline; T—terrace; L—lenticular; Str—stratigraphic. †Million cubic feet.

27 oil wells have been completed in these two reservoirs.

A total of 22 oil wells have been completed from the Jurassic Sundance sand.

First oil from the Pennsylvanian Tensleep formation was obtained on October 7, 1930, by the Prairie Oil & Gas Co. (now Sinclair). Lost Soldier A-75, NW SW NW 11-26n-90w; initial production was 2,435 bbl. of oil per day by natural flow, from Tensleep sand topped at 3,935 ft.

On January 4, 1948, the Madison reservoir was proven productive by Sinclair's Lost Soldier area "A"-77, SE NE NE 10-26n-90w. Initially, this well flowed 1,045 bbl. of oil in 24 hours on gas lift through 2⅜-in. tubing bottomed at 5,017 ft. in Madison encountered at 4,722 ft.

First commercial oil production to be found in the Cambrian strata in the Rocky Mountain province was discovered on June 26, 1948, by Sinclair's 2 Drayton Consolidated, SE NE SE 3-26n-90w. Initial production was 720 bbl. of oil in 24 hours on gas lift at a total depth of 6,288 ft. in Cambrian topped at 5,472 ft. Six additional oil wells have been completed from the Cambrian Flathead sandstone.

Wertz dome . . . A major field that rivals Lost Soldier in multiplicity of pay zones and recoveries is Wertz dome. It is the most westerly of a series of domes which lie on a 25-mile anticlinal trend south of and parallel to the Sweetwater uplift (Ferris Mountains).

Cumulative recovery from all reservoirs to January 1, 1953, was 23,834,468 bbl. from 27 oil wells.

Separated from prolific Lost Soldier by a deep syncline, Wertz dome is 2,000 ft. structurally lower than that field. Wertz dome was discovered on surface geology and the structure was mapped on scattered outcrops of the more resistant beds in the Steele (Cody) shale and on prominent ledges of Mesaverde sandstone, which disclosed more than 1,500 ft. of structural closure.

First commercial gas production on Wertz dome was discovered in 1920 by Producers & Refiners Corp. No. 1 test, NE SW 7-26n-89w, which was completed for an initial production of 42 M.M.c.f. of gas per day from a 60-ft. pay zone in the Cretaceous Muddy sand found at 3,435 ft. In all, six wells were completed in the Muddy and the Dakota-Lakota zones over a proved area of 500 acres; cumultive recovery exceeds 66,500 M.M.c.f. of gas.

First oil-well completion at Wertz dome was finaled in December 1936 by Sinclair Wyoming Oil Co. 10 well, SE NW 7-26n-89w; initial oil production was 1,700 bbl. of 36°-gravity oil per day from a 14-ft. penetration of the Pennsylvanian Tensleep sand found at 5,886 ft. About 24 wells have been drilled over a proven area of 980 acres in the Tensleep; however, some of these wells have been deepened since to the Darwin, Madison, and Cambrian sands. Estimated ultimate recovery from the Tensleep is 27.7 million barrels.

Original reservoir pressure in the Tensleep was 2,600 psig. Since July 1941, gas injection has been employed to stabilize the reservoir pressure near 2,140 psig. Most of the gas used is dehydrated formation gas; the remainder is makeup gas produced from sands lying above the Tensleep.

Success of gas injection in the Tensleep reservoir at Wertz dome can be attributed to a volumetric balance be-

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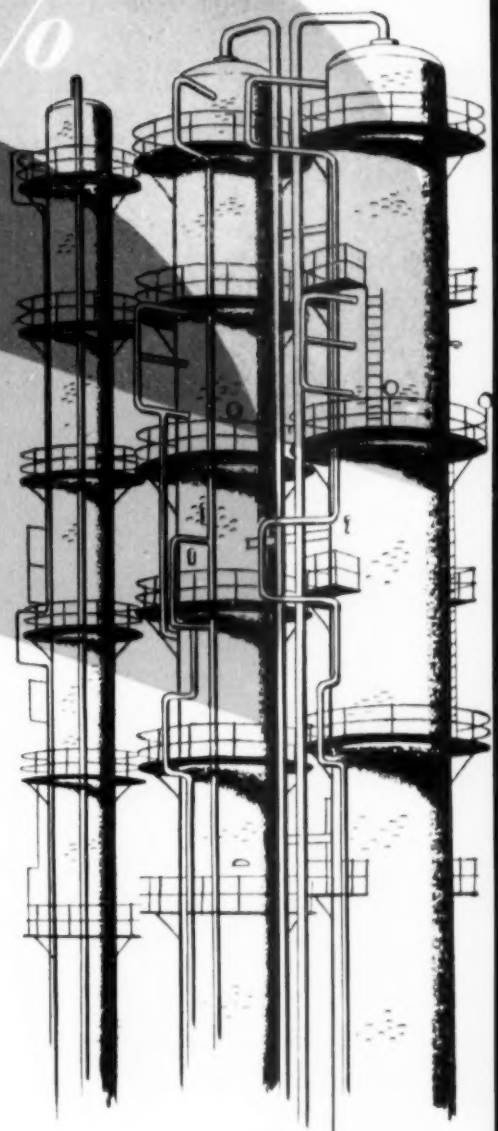
High vapor thruput	−	+
Low liquid thruput	+	−
High liquid thruput	−	+
Low pressure drop	−	+
High pressure drop	+	−
High pressure towers	−	+
Low pressure towers	+	+
Alloy or alloy-clad towers	−	++
Shop fabricated towers	−	+
Field fabricated towers	−	++



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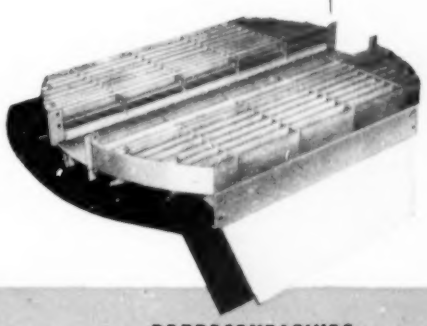

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tween oil withdrawals, gas injection, and water encroachment, at a reservoir pressure that will utilize energy of the hydrostatic head and will support flowing conditions in the wells.

Crooks Gap field . . . Recoveries of 35,000 bbl. per acre are expected from all three sand zones in the prolific Crooks Gap oil field in southeastern Fremont County, Wyoming. This field lies 15 miles northwest of Lost Soldier field and 70 miles southeast of Lander.

Average daily production for the Lakota reservoir for June 1953 was 1,461 bbl. and for the Muddy reservoir 259 bbl. per day. A summary of reservoir data appears in an accompanying tabulation.

A total of seven oil wells have been completed to date in development of a proven area of 320 acres from the Lakota and Muddy sandstone reservoirs. Cumulative field recovery to July 1, 1953, was 5,209,874 bbl.; Lakota production accounted for 4,408,547 bbl. and Muddy for 801,327 bbl.

RESERVOIR DATA—CROOKS GAP FIELD, FREMONT COUNTY, WYOMING
(Data from Sinclair Oil & Gas Co.)

Wells:	Muddy	Lakota-Dakota
Oil wells	*3	4
Pay depth, ft.	4,900	5,200
Proven acreage	180	320
Pay thickness, effective, ft.	20	120
Media:		
Porosity, per cent	15-20	20
Permeability, md.	20-50	40
Interstitial water, per cent	45	35
Pressure, orig. psig.	2,175	2,082

*Dual completions with the Lakota reservoir.

Crooks Gap anticline is located along the southern portion of the Sweetwater uplift. This narrow, asymmetric anticline has a steep southwest flank which is nearly vertical; the average dip along the long northeast flank is about 32°. Numerous transverse faults cut the structure. Approximately 3,000 ft. of structural closure is indicated on exposures of the Shannon sandstone member of the Steele (Cody) shale of Upper Cretaceous age.

Happy Springs . . . Northwest of Crooks Gap field, Sinclair Oil & Gas Co. has three active drilling rigs working in development work in the Frontier, Muddy, and Dakota sand reservoirs. Cumulative oil production to June 1, 1953, was 458,867 bbl. Daily average oil production for May 1953 was 1,503 bbl.

Happy Springs field is located in T. 28 N., R. 93 W., on the southern

MIDDLE MOUNTAIN UNIT Mesaverde discovery well is the highest oil-producing well in the United States.

margin of the Sweetwater uplift in southeastern Fremont County, Wyoming. The anticline was found by seismic methods since Tertiary beds unconformably overlap the Cretaceous Steele shale and cover surface indications of the structure.

Subsurface well data indicate that the Happy Springs anticline is a long, asymmetrical, northwest-trending fold with steep dips on the southwest flank. In the discovery well, 57° dips were encountered in the Tensleep horizon which proved that the test crossed the axial plane and bottomed on the steeply dipping southwest side of the structure.

A single completion has been made in the Muddy sand which is a dual completion with the Frontier. Muddy sandstone has exhibited low productivity in the Happy Springs field. A total of eight oil wells are productive from the Cretaceous Frontier reservoir. During May 1953, daily average production was 570 bbl. of oil from these wells. Cumulative recovery from this reservoir to June 1, 1953, was 236,833 bbl.

Since discovery date of Dakota sandstone reservoir on February 4, 1952, cumulative production from this pay zone was 201,721 bbl. of oil to June 1, 1953. During May 1953, seven oil wells produced 894 bbl. per day.

Mahoney field . . . A prolific Tensleep oil reservoir lies east of Lost Soldier field in Mahoney field of Sweetwater County. A total of nine Tensleep oil wells productive from a depth of about 4,500 ft. have produced on the average 341,276 bbl. of oil each. Cumulative recovery for the reservoir to July 1, 1953, was 3,071,487 bbl.

Discovery well in the Tensleep was completed August 8, 1929, by Sinclair Oil & Gas Co. F-2 which was finaled at a total depth of 4,760 ft. Method of discovery was surface geology.

Daily average Tensleep production from the Tensleep reservoir was 285 bbl. of oil per day for June 1953.

Middle Mountain . . . Production is being developed from the Mesaverde sand of Upper Cretaceous age at 6,534-44 ft. in Stanolind Oil & Gas Co. 1 Middle Mountain Unit, SW NE NE 10-12n-103w, discovered on top of Pine Mountain in Sweetwater County, Wyoming. It is the highest producing oil well in the United States and has a ground elevation of 9,300 ft. above sea level.

Natural-gasoline plant . . . Sinclair Oil & Gas Co. operates a natural-gasoline plant in the Lost Soldier-Wertz area. It has a daily capacity of 11,970 gal. of natural gasoline.

In Church Buttes field of Uinta County, Wyoming, Mountain Fuel Supply Co. owns and operates a small natural-gasoline processing plant which has a daily capacity of 21,000 gal. of liquids.

RESERVOIR DATA—LOST SOLDIER FIELD, SWEETWATER COUNTY, WYOMING
(Data from Sinclair Oil & Gas Co., Tulsa)

Wells:	Dakota	Sundance	Tensleep	Madison	Cambrian
Pumping	1	17	24	2	4
Gas lift	0	1	0	4	3
Total	1	18	24	6	7
Density, acres/well			40.8	126.5	150
Gas-oil ratio, cu. ft./bbl.			125	100	100
Produced gravity, °A.P.I.	30.7	30.7	35	36	36.4
Reser. press. orig., psig.			2,052	1,350	2,670
Production:					
Daily average, 7-1-53	9	314	4,067	2,981	2,597
Cumulative rec. to 7-1-53	262,871	8,169,796	20,434,353	6,624,729	4,138,436

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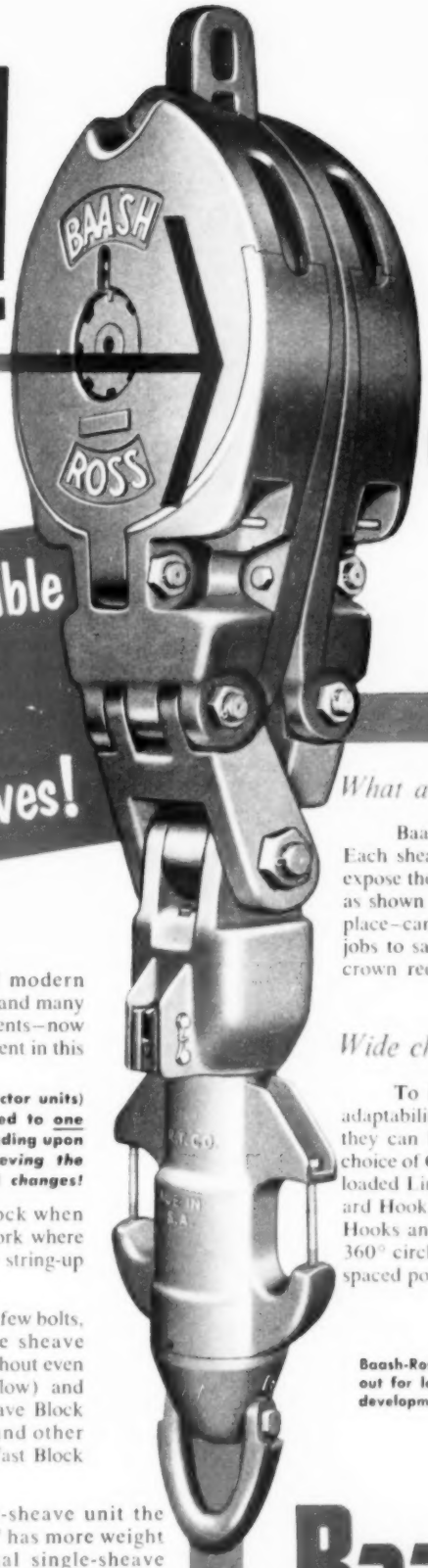

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Rockies' Newest Intermontane Basin

THE Uinta basin of northeastern Utah, now recognized as harboring one of the outstanding undeveloped oil reserves of this country, became productive of oil in commercial quantities more recently than any other intermontane basin of the Rockies.

The first coordinated, full-fledged search for oil in the Uinta basin did not begin until 1944 even though the existence of hydrocarbons on the surface had been known for many years. The Uinta basin had been so completely neglected, not because of its remoteness, but because of an idea that oil was to be found only in marine sediments. In fact, this idea was in vogue until the completion of the discovery well of the Uinta basin's Roosevelt field in 1949. Production was found in a fractured zone of the Eocene-Green River, a laminated, impure carbonate of lake origin. The more than 800,000 bbl. of oil produced at Roosevelt field and the completion of additional discoveries scattered across the basin have changed the once-skeptical attitude toward the Uinta basin and nonmarine sediments wherever they are found in great volume.

Geologic Sketch

The Uinta basin is a structural and topographic basin in northeastern Utah about 110 miles north-south and 130 miles east-west. It is bounded on the north by the east-west trending Uinta Mountains; on the east by the Douglas Creek arch, which separates the Uinta and Piceance basins; on the southeast by the Uncompahgre uplift; on the southwest by the San Rafael swell; and on the west by the north-south trending Wasatch Mountains.

The basin is asymmetrical. Its axis runs east-west just south of the Uinta uplift, making the major portion of basin is a northward dipping monocline.

Currently the most important formations in the Uinta basin proper are of Tertiary-Eocene age. These sediments were deposited in a lake which existed from early in Paleocene time through the Eocene and into early Oligocene time. During Green River time this lake reached its maximum development and deposited highly organic sediments that were to become the much-publicized oil shales of the area and were the source of the abundant gilsonite veins in the eastern and central parts of the Uinta basin. The Uinta and Wasatch formations, overlying and underlying the Green River, respectively, are predominantly nonlacustrine throughout most of the basin area.

Producing formations . . . Sediments in the Uinta basin range in age from Oligocene through Cambrian. In the area of the basin axis these sediments

Drilling and Production Data, Uinta Basin

Field and county—Producing name and formation age—	Year disc.	Type Str.*	Pay depth	Grav. oil, °A.P.I.	Wells: Flowing	Wells: Pumping	Wells: Total	Wells: Drlg.	Acres proved devel.	Oil production: B/D	Oil production: Cum. 7-1-53
UTAH, OIL:											
Antelope, Duchesne—Green River—Tertiary sand	1952	Str	6,529-54	39	0	1	1	0	40	8	640
Ashley Valley, Uintah — Weber — Permian, Pennsylvanian sand	1948	A	4,130-4,320	32	0	30	30	0	780	2,796	4,026,166
Chapita Wells, Uintah—Mesaverde—Cretaceous sand	1953	Str			1	0	1	0	80		
County Area, Duchesne—U. Green River—Tertiary sand	1953	Str	5,257		1	0	1	0	80		
Duchesne, Duchesne—Green River—Tertiary sand	1951	A	7,480-7,660	44	0	2	2	0	80	131	101,514
Flat Mesa, Duchesne—Green River—Tertiary sand	1952	Str	8,820-9,103	42	0	1	1	0	40	81	15,468
Gusher, Uintah—Green River—Tertiary sand	1950	Str	8,720-8,790	30	0	1	1	0	40	S.I.	1,870
Myton South, Uintah—Green River—Tertiary sand	1952	Tf	6,092-6,310	35	0	2	2	0	80	S.I.	1,350
Rangely, Rio Blanco—Mancos, Weber—Cretaceous, Pennsylvanian, shale, sand	1902	A	850-5,955	39-43			529	0	19,200	61,970	131,648,383
Red Wash, Uintah—Green River—Tertiary sand	1951	Str	4,980-5,750	34	0	20	20	5	800	1,396	825,271
Roosevelt, Uintah — Green River — Tertiary limestone, sand	1949	Str	8,900-10,100	33	0	8	8	2	320	790	956,161
Wilson Creek, Rio Blanco—Morrison—Jurassic sand	1938	A	5,897-6,410	49			35	0	2,843	7,970	25,805,572
UTAH, GAS:											
Clear Creek, Carbon — Ferron — Cretaceous sands	11-51	Af	4,690		7	0	7	3	8,960		
Gordon Creek, Carbon—Ferron—Cretaceous sands	11-52	Af	3,416		1	0	1	1	640		
Peters Point, Carbon—Wasatch—Eocene sand	7-53	A	2,780		1	0	1	0	640		

*Legend: A—anticline; Af—faulted anticline; T—terrace; L—lenticular; Str—stratigraphic; M—monocline.

may reach a thickness of 25,000 to 30,000 ft. Pre-Tertiary rocks crop out around the edge of the basin and in this area the Pennsylvanian-Weber has been found oil bearing at Ashley Valley and Rangely fields.

In the Tertiary province of the Uinta basin, the Eocene-Green River and the Wasatch-Green River transitional zone are the only rocks yielding commercial oil production at present. These rocks are more than 5,000 ft. thick near the axis of the basin. The Green River is truncated on the north and thins eastward and southward from the basin axis. Oil is found in fractures and sands in the basal Green River section and recently was found in fractures in the middle Green River.

There have been some significant shows of oil and gas found in the Cretaceous - Mesaverde formation on the south flank of the Uinta basin well within the Tertiary province. In the Uinta basin area, but specifically on the Wasatch plateau, large-volume gas wells are being completed in the Ferron sands of Cretaceous age.

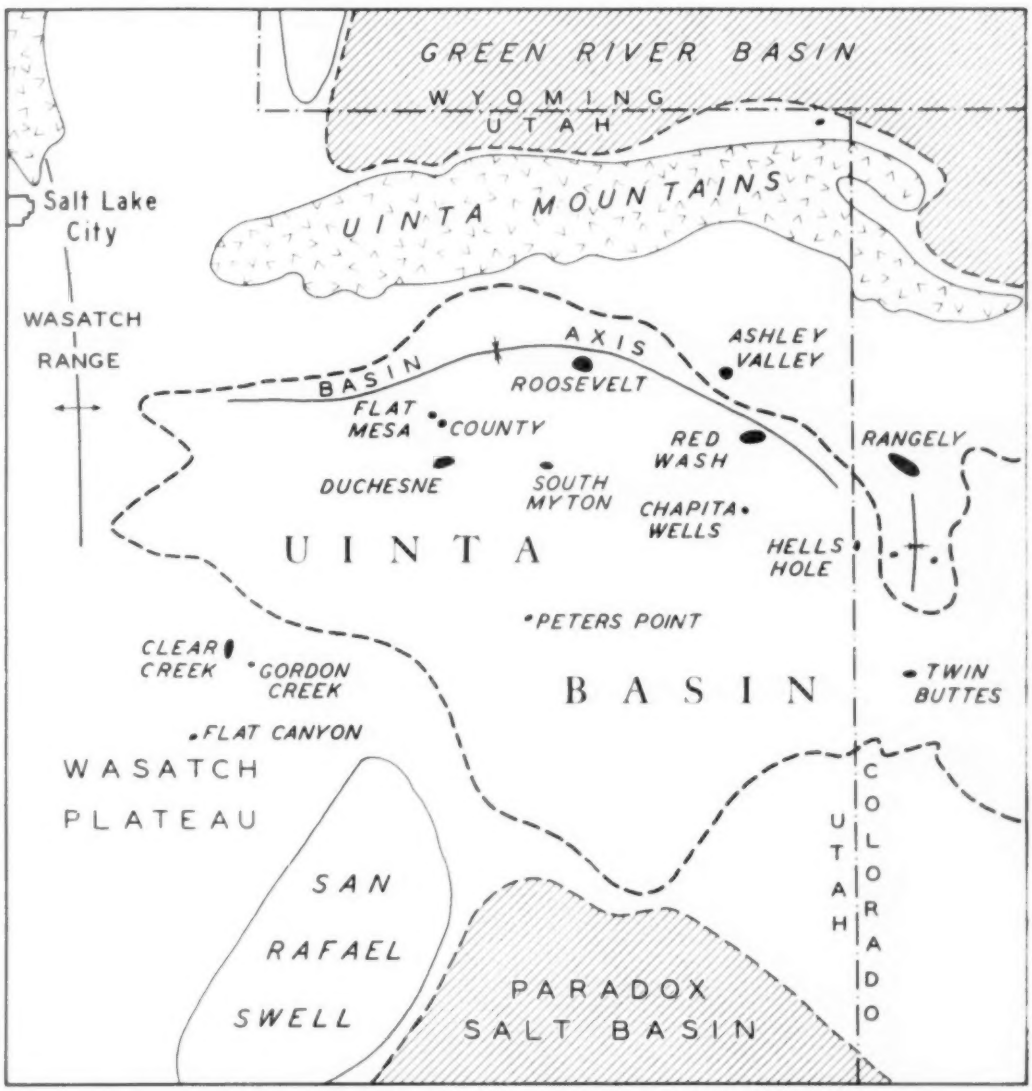
Producing Fields

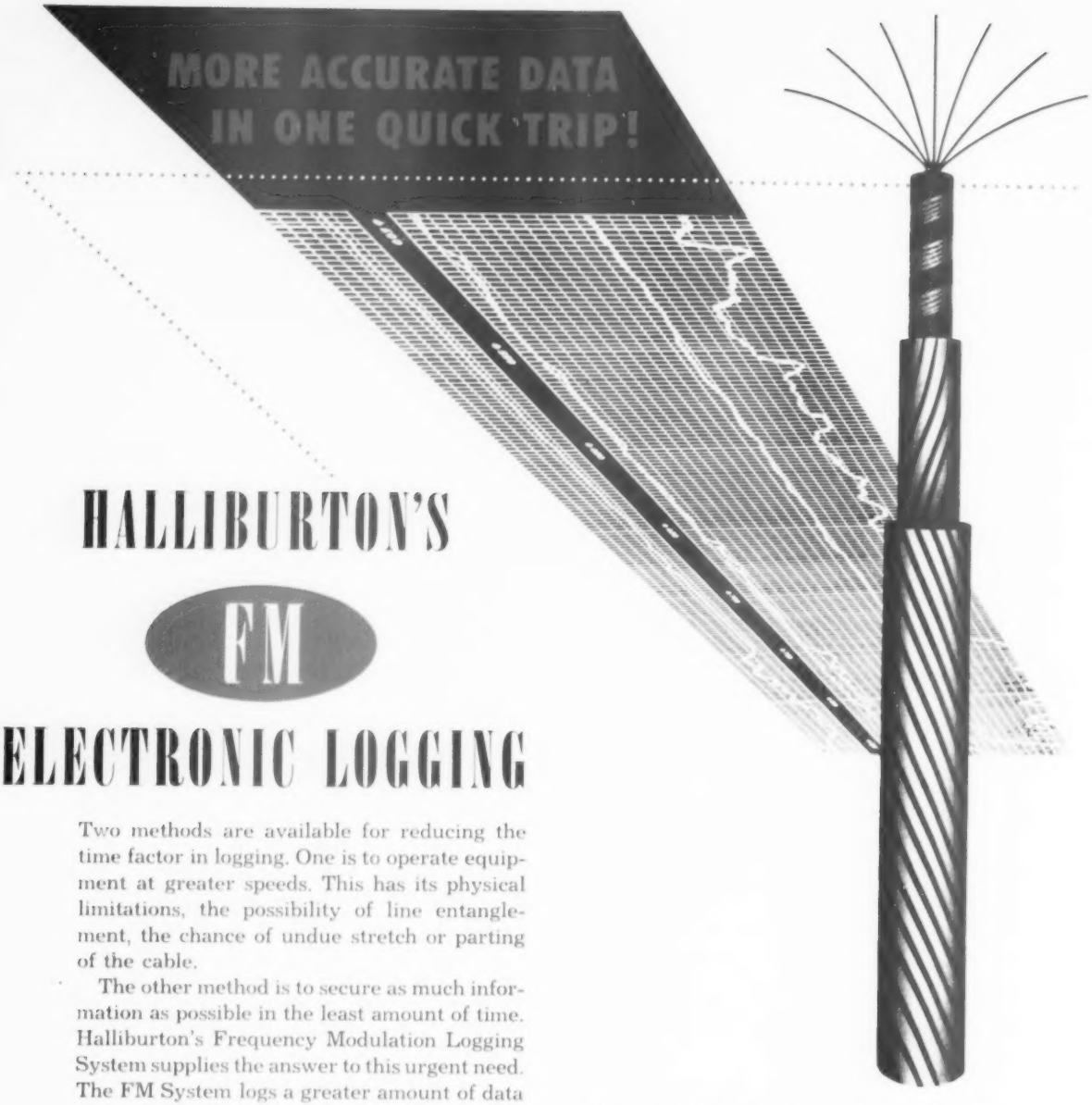
(See accompanying table)

Oil and gas fields within the Uinta basin are restricted to Tertiary rocks of Eocene and Paleocene age except for a one-well field which produces oil from the Cretaceous-Mesaverde. The three gas fields off the southwestern corner of the basin produce from Cretaceous sands. The two oil fields northeast and east of the basin produce from the Pennsylvanian-Weber and in the same general area there is a one-well gas field in the Mesaverde.

Roosevelt . . . The first discovery of commercial oil within the Tertiary Uinta basin was Roosevelt field. The discovery well, drilled by Carter Oil Co. and Stanolind Oil & Gas Co., was completed in 1949. This well, located on a seismic anomaly, produced 1,633 bbl. of 35°-gravity oil from a fractured zone of oil shale in the basal Green River formation at about 9,400 ft. The oil is dark green to black and has a pour point of 90° F.

Roosevelt field now has 11 producing wells and only 1 dry hole. Subsurface studies indicate that the field is on a broad nose which plunges to the





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northwest. No closure on the east can be demonstrated.

Red Wash . . . The second discovery within the Tertiary Uinta basin was Red Wash. This field was opened by The California Co. in January 1951. The field produces from a series of thin sandstones in the basal Green River formation found at about 5,500 ft. The crude produced at Red Wash is similar to that of Roosevelt field.

The discovery well of Red Wash was located on the basis of seismic work. Like Roosevelt, the field is on a nose. This nose, however, plunges westward and is better developed than the structure at Roosevelt. Last year Red Wash production was extended nearly 2 miles to the northeast by a Carter Oil Co. discovery called Walker Hollow.

Others in basin . . . There are three other commercial fields in the basin producing from the Green River-Wasatch section. Duchesne produces from a fractured Green River section at about 7,500 ft. Crude from this field is light yellow, has a gravity of 43°, and a pour point of 100° F. Flat Mesa produces from two zones in the basal Green River section at about 9,000 ft. One zone is fractured and the other is a sandstone. This new field's oil is light orange, has a gravity of 42°, and a pour point of 90°. County field is about 3 miles southeast of established production in Flat Mesa. The field's discovery well was drilled as a confirmation test for Flat Mesa but found production in the middle Green River section above 5,200 ft. Here the oil, which is black, has a gravity of 23.5° and a pour point of only 30°. This latest commercial discovery in the basin flowed 239 bbl. of oil and 30 bbl. of water from fractures on an initial 22½-hour test.

South Myton, also known as Pleasant Valley, is a noncommercial Green River discovery, completed last year for 6 bbl. daily of high-pour-point oil. Chapita Wells is the basin's Mesaverde oil producer. This 1953 discovery was completed for 62 bbl. of oil and 4 bbl. of water in 4 hours on a 14/64-in. choke. At Peters Point is a recent gas discovery well which flowed 2,120 M.c.f. of gas daily from the Wasatch above 3,231 ft. Hells Hole is a one-well Mesaverde gas field. The discovery well had an initial flow of 11,200 M.c.f. of gas daily at 2,500 ft.

Rangely . . . The biggest producing field in the Rocky Mountain area is Rangely. This field is the sixth biggest producer in the United States. It was discovered in 1902 when production was established in the Mancos shale. Production in the Weber was discovered in 1931 but it was not until 1943 that development of the Weber reservoir on this big anticline really got under way.

Ashley Valley . . . The first commercial oil discovery in Utah was Ashley Valley. This field lies outside the Tertiary Uinta basin but is within the Uinta basin province. Like Rangely, the field produces from the Weber on an anticlinal structure.

Clear Creek and Gordon Creek . . . These two gas fields off the southwest corner of the Uinta basin indicate the potentialities of the Wasatch plateau as a gas producer. Both Clear Creek and Gordon Creek produce from Ferron sandstones of Cretaceous age. To the south of these fields is Flat Canyon, a recent discovery which initialed 7 M.M.c.f. of gas daily from the Dakota.

Geophysical activity . . . Uinta basin is the major area under exploration in Utah and accounted for the major portion of geophysical activity. During 1952 seismic work totaled 395 crew-weeks and gravimeter crew-weeks 43; this compares with 473 crew-weeks of seismic work and 10 crew-weeks of gravimeter during 1951.

Drilling problems . . . Principal drilling problems encountered in the development of highly fractured oil and gas reservoirs in some fields in the Uinta basin are (1) extremely slow penetration rates and (2) lost-circulation conditions. These problems are common in Red Wash, Roosevelt, Duchesne, and Gusher fields.

Hard, abrasive Tertiary sediments slow penetration rates to an average of around 4 ft. per hour, with a weight on bit of 30,000 lb. Bit performance in the Green River formation for 9-in. bits at a depth of 7,500 ft. with an average rotary-table speed of 70 r.p.m. ranges from only 30 to 40 ft. Penetration rates for 9-in. rock bits have dropped to only 1 ft. per hour with less than 10 ft. of formation cut per bit used.

Loss of drilling fluid, which is common in the fractured Uinta basin reservoir, has been held in balance by some contractors through maintaining of mud weight within certain limits. Water loss is held to as low a value as possible to prevent contamination of formations by mud filtrate.

Standard practice of operators and contractors in the Uinta basin fields is to set long string on top of the first oil pay in the basal Green River formation, drill ahead with diamond core heads, drill-stem test each zone, and finally complete by swabbing the well into production. Special applications have been made of caliper surveys to show enlargement of bore hole with pay zones, and temperature surveys to point up pay development. These practices are employed in addition to regular procedure of conducting electrical and radioactivity well logs.

Developmental drilling . . . Drilling conditions analyzed in the Roosevelt pool by E. A. Polumbus, Jr., Denver, typify development operations in the Uinta basin. The following features are significant:

1. Considerable amount of continuous footage and full-hole diamond coring.
2. Relative low footage per hour (5.9) and low footage per bit (68) for a 7,898-ft. hole drilled with 9-in. rock bits.
3. Relatively high drilling weights (maximum 17½ to 20 tons).
4. Large number of drill collars used (maximum twenty 6¼-in.).
5. Relatively large number of bits used.
6. Large number of drill-stem tests taken and time consumed in testing (from time analysis: 20 days).

Exploratory drilling . . . Sinclair Oil & Gas Co. 1 Coleman, a 10,003-ft. exploratory well in Duchesne County, Utah, required 115 bits and 218 days to reach total depth.

Production methods . . . Crude oil produced from Green River (Eocene) reservoirs in the Uinta basin exhibit high pour points. Pour point of the Roosevelt pool crude is 90° F., for example, and this condition presents several production problems.

The Kobe hydraulic pumps are employed for lifting oil produced from this field. Heat is introduced into the power oil and the temperature is raised to as high as 180° F. In addition, steam coils are employed in maintaining high temperatures in both the Kobe power oil tanks and the crude-oil stock tanks. For emergency use, a steam line has been run from each well paralleling the flow line, the Kobe power oil line and the gas line; all of these lines are wrapped together into a single bundle.

Paraffin removal is a major producing problem at Roosevelt. A soluble plug is introduced into the tubing head of each well every other day to dissolve

RANGELY FIELD, COLORADO, the nation's sixth largest oil field, viewed here, currently produces 61,970 bbl. daily from more than 19,200 acres.

solid paraffin accumulations in the well bores.

The oil is pumped into insulated tank trucks but no reheating is required for transportation. The crude is trucked by contractor to Salt Lake City where it is purchased by Utah Oil Refining Co. for processing.

In another production technique, an indirect heater is set at each well head for a flow line heater in order to keep production at a high enough temperature to prevent congealing in the lines. Before separation, the production is subjected to an additional heat through a steam heat exchanger so that gas can be properly separated from the oil in the oil and gas separator.

Each tank is thermostatically controlled at 110° F. preparatory to being shipped by truck. A 4 by 15-ft. 2,000,000 B.t.u. 15 psi. w.p. steam generator is installed along with coils in each tank to keep the production to 110° F. in the stock tanks.

This is a closed system with the generator set at a lower level than the tankgrades and the condensate line is buried from the tanks back to the unit. Surface temperatures in this area range sometimes as low as 40° F. below zero during the winter months.

Gas repressuring . . . Gas-repressuring operations were due to commence on August 31, 1953, in Rangely field of northwestern Colorado, largest producing area in the Rocky Mountain region. This was the effective date for initiation of gas return to the Weber sandstone in a measure to halt gas flaring ordered by the Colorado Oil and Gas Conservation Commission.

Rangely, the nation's sixth largest oil field, has remaining crude-oil reserves estimated at about 200 million barrels. Cumulative recovery to January 1, 1953, was 120,402,950 bbl. Its 531 producing oil wells are currently producing about 61,000 bbl. per day from 19,200 productive acres.

Set in a waste of dry washes and barren clay ridges at an elevation of 6,500 ft. above sea level, Rangely is situated in the Piceance portion of the Uinta basin.

Market outlets . . . Crude oil produced from the Uinta basin fields contain so much wax that no wholly satisfactory method has yet been adopted. Two temporary expedients have been used but together they move a relatively small amount of crude. One method is by tank-truck delivery to refineries which is uneconomic and which at present is prohibited by the Utah Highway Department because of the poor conditions of roads in the area. The second is blending the viscous crude with Rangely field crude and piping both to Salt Lake City. About 1,200 bbl. daily is now reaching Salt Lake City, trucked from Red Wash field to Rangely and blended with Rangely crude. It is estimated that possibly twice this amount could be blended without plugging the line with wax.

While the Uinta crudes contain relatively little straightrun gasoline, they are in demand by established Salt Lake City refineries because these crudes exhibit a low sulfur content and constitute good cracking stocks. But the wax content of the Uinta crudes is high, and pour points range up to 115° F.

Sure Seal Corp., Salt Lake City manufacturer of wax and wax products, signed a purchase contract during the spring of 1953 with Carter Oil Co. to purchase Uinta basin waxy crude oil, at the Mid-Continent price for such crude.

Refining installations . . . Salt Lake City has the greatest concentration of crude-oil-charging capacity of any refining area in the Rocky Mountain province. Four plants in the environs of that city have a combined crude oil charging capacity of 71,500 bbl. per day or nearly one-third of the Rockies' 250,516 bbl. per day of crude-oil capacity.

Largest refinery in the Salt Lake City district is Utah Oil Refining Co.'s 28,000-bbl. per day plant. It has 7,200 bbl. per day of cracking capacity and 16,000 bbl. per day of catalytic cracking capacity of the fluid type. The lube plant has a capacity of 120 bbl. per day.

Salt Lake Refining Co.'s 27,000-bbl. per day crude-oil plant has 13,000 bbl. per day of Houdriflow catalytic cracking facilities.

Phillips Petroleum Co. can charge up to 10,000 bbl. per calendar day at its Woods Cross refinery located on the outskirts of Salt Lake City. It has 3,000 bbl. of vacuum-distillation capacity. Catalytic cracking facilities of the Thermofor type can process 8,000 bbl. per day. In addition it has 200 bbl. per day of catalytic polymerization facilities. Straightrun asphalt production facilities are rated at 900 bbl. per day.

In addition, Western States Refining Co. has 3,000 bbl. of crude-oil cracking capacity at its North Salt Lake City plant, and Uinta Oil Refining Co.'s Jensen, Utah, plant has 1,500 bbl. of distillation capacity.

ALIDADE AND PLANE-TABLE party working in the San Juan basin; the famous Shiprock intrusion feature appears in the background.

TYPICAL DRILLING RIG working for Phillips Petroleum Co. in the San Juan basin, New Mexico.

SAN JUAN

Rockies' Greatest Gas-Producing Basin

CURRENT gas production in the San Juan basin amounts to 60 billion cubic feet annually, making this basin by far the greatest gas-producing area in the Rocky Mountain region. Gas reserves in the basin have been estimated at 15 trillion cubic feet.

Exploration activity and development drilling in the San Juan basin is at an all-time high. Though some oil is being found it is the once-considered-useless natural gas that is being sought with accelerating intensity.

Prior to the end of World War II, unfavorable marketing conditions dampened any enthusiasm that might have developed over the gas-producing capabilities of this area. After the war, however, the recognition of the value of natural gas in this country's industrial economy and the initiation of construction of a large-diameter gas line to the big, gas-hungry marketing areas of the West Coast set off wildcat and development activity which is still in high gear today.

Though few of the wells in the central portion of the basin are truly big gas producers, a completely gasless well is unknown. Nearly all of the once spotty gas-producing areas of this portion of the basin are merging into one tremendous gas field.

Geologic Sketch

Though principally in northwestern New Mexico, the San Juan basin includes a small portion of southwestern Colorado. This structural and topographic depression measures about 125 miles north-south and 100 miles east-west. The basin is bounded on the north by the La Plata Mountains of Colorado, on the northeast by the San Juan Mountains and the San Juan volcanic area of Colorado and New Mexico, on the east by the westward-thrust Nacimiento Mountains, on the south by the volcanic Mount Taylor and the Zuni uplift, and on the west by the Defiance uplift and the Carrizo Mountains, both in Arizona.

Except for the San Juan Mountains, which began developing about the close of Cretaceous time, the basin's present-day limiting features did not begin to form until after the beginning of the Tertiary. The two uplifts that influenced pre-Mesozoic sediments of the basin were the Uncompahgre-Sangre de Cristo uplift, which was located in southwestern Colorado and extended into North-Central New Mexico; and the Defiance-Zuni uplift of Arizona and New Mexico, which lay near the present southwestern border of the San Juan basin.

Strata in the central portion of the basin are nearly flat lying, forming monoclines with very slight dips toward the center of the basin. These strata have rather sharply upturned edges on the flanks of most of the basin's limiting uplifts.

Producing formations . . . Sediments in the San Juan basin range in age from Tertiary through Cambrian. In the central portion of the basin there is a probable thickness of 14,000 ft. of sedimentary rocks. Volcanic plugs, dikes, and lava flows are common and in many parts of the basin form prominent surface features.

The great volume of gas proved and indicated for the San Juan basin occurs in Cretaceous and Pennsylvanian rocks. Oil production is restricted to the Cretaceous but there have been encouraging shows in the Mississippian-Leadville and the Jurassic-Wingate.

The big gas fields of the central portion of the San Juan basin produce principally from sandstones of the Pictured Cliffs and the Mesaverde group, both of Cretaceous age. The deeper Cretaceous-Dakota, which has been found to carry gas condensate, is scheduled to play an increasingly important role in the basin's production. Pennsylvanian gas has been found in the northwest portion of the San Juan basin area. Here the Hermosa-Paradox is gas bearing at Barker Creek dome, Ute Dome, and at North Chimney Rock, a recent discovery about 20 miles southwest of the big Barker Creek field.

The only oil field in the central por-

tion of the San Juan basin is Doswell, which produces from the Cretaceous-Tocito. The small oil fields on the northeastern, western and southern sides of the area produce from the sandstones in the Mesaverde group, the Mancos shale, and the Dakota.

Producing Fields

(See accompanying table)

The San Juan basin gas fields have had a phenomenal growth since the prospect of a profitable and adequate market outlet became assured about 1949. These fields are still expanding and their areal limits are so well recognized that successful outposts several miles from production are reported as extensions rather than discoveries.

Oil fields . . . Oil production in the San Juan basin is less than 700,000 bbl. annually. This production comes from a few small, widely scattered fields outside the basinward limits of the Mesaverde sandstone outcrop and from a limited number of Cretaceous sand producers within the central portion of the basin.

Doswell oil field, which lies in the easternmost portion of the Kutz gas trend, is the biggest oil producer in the basin. It accounts for more than half of the oil production of the area. This field produces from the Tocito sandstone and apparently is a stratigraphic trap with no apparent structural control.

The only other oil field in the San Juan basin that produces more than 100,000 bbl. annually is Hospah. Angels Peak (in Kutz gas field), Hogback, Lindrith (at the southern end of Gavilan gas field), Rattlesnake, Red Mountain, Stony Butte, and Table Mesa are small oil producers. All are producing high-gravity oil from the Dakota except Red Mountain which produces from the Mesaverde.

Barker Creek dome . . . Commercial gas production was developed in the Dakota at Barker Creek dome in 1941. Actually this reservoir was discovered in 1925 but, due to lack of market, the 30,000-M.c.f. gas well was plugged and abandoned. The lower Paradox limestone was proved in early 1945. This field is a prominent asymmetrical anticline well defined by surface exposures of sandstone of the Mesaverde formation. Axis of the structure trends northeast-southwest. Effective structural closure on top of the Paradox is indicated to be about 500 ft. The gas reservoir within effective closure is a highly fractured and jointed, dense, impure limestone. There are three zones characterized by intercrystalline, vugular, and semicavernous porosity separated by dense siliceous limestones.

North Chimney Rock . . . The most recent Pennsylvanian discovery in the San Juan basin is North Chimney Rock. The discovery well, Southern Union Gas Co. 1-A Navajo, tested 13,900 M.c.f. of gas daily through 27/8-in.

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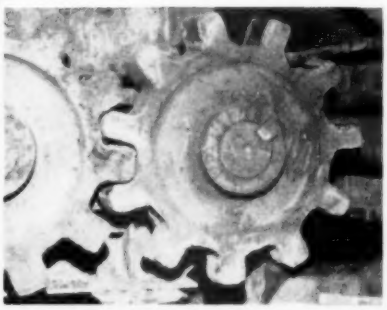

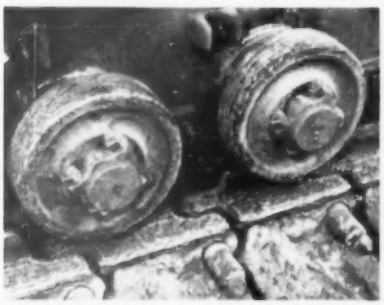

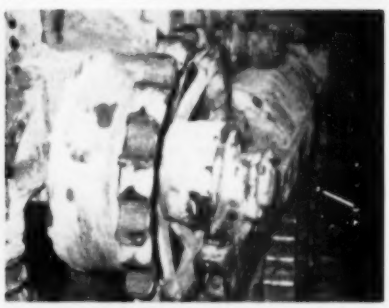

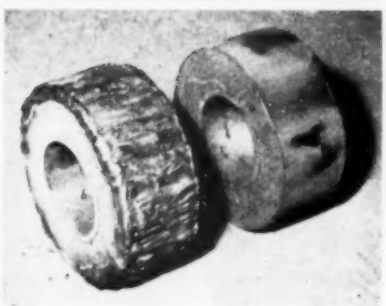

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Drilling and Production Data, San Juan Basin

Field and county—Producing name and formation age—	Year disc.	Type Str.*	Pay depth	Grav. oil, °A.P.I.	Wells: Flowing	Wells: Pumping	Wells: Total	Wells: Drlg.	Acres proved devel.	Oil production: B/D	Oil production: Cum. 7-1-53
COLORADO, OIL:											
Chromo, Archuleta — Mancos (Greenhorn)—Cretaceous limestone, sand, shale	1947	A	470	33		13	13	0	80		68,387
†Mancos Creek, Montezuma—Mancos—Cretaceous sand	1924	A		40			1	0			3,816
Price (Gramps), Archuleta—Dakota, Morrison—Cretaceous sand	1935	Af	955	32		9	9	0	127		3,719,078
Red Mesa, La Plata—Mancos, Point Lookout—Cretaceous sand	1924	A	2,115-4,750			4	4	0	40		
NEW MEXICO, OIL:											
Angels Peak, San Juan—Dakota—Cretaceous sand	1947	A	6,490	40					40		‡13,610
Barker Creek, San Juan—Hermosa—Pennsylvanian limestone	1941	A	9,160								‡19,672
Blanco S., San Juan—Mesaverde—Cretaceous sand	1927	T	4,550								‡230,706
Doswell, Rio Arriba—Mancos (Tocito)—Cretaceous sand	1952	Str					10		400	1,057	400,330
Hogback, San Juan — Dakota — Cretaceous sand	1922	A	633	60			6		160	192	2,938,576
Hospah, McKinley — Mesaverde—Cretaceous sand	1927	A	1,500	31			43		960		3,075,995
Lindrith, Rio Arriba — Dakota — Cretaceous sand	1949	A	7,670	43			1		40		7,950
Rattlesnake, San Juan—Dakota, Paradox—Cretaceous, Pennsylvanian, sand, dolomite	1923	A	685	60			29			87	5,509,647
Stony Butte, San Juan—Dakota—Cretaceous sand	1950	A	3,645	48			1			40	6,822
Table Mesa, San Juan—Dakota—Cretaceous sand	1925	A	1,315	56.5			5		160	56	984,687
Ute Dome, San Juan—Dakota—Cretaceous sand	1921	A	2,190				*3		320		‡8,065
COLORADO, GAS:											
Barker Creek, La Plata—Hermosa—Pennsylvanian limestone	1948	A	9,160		4		4		3,400		
Ignacio, La Plata—Fruitland, Pictured Cliffs—Cretaceous, Jurassic, Morrison, sand	1950	A	2,560-7,363		10		10		6,400		‡10,842
Red Mesa, South, La Plata—Point Lookout—Cretaceous sand	1952	A	5,690		3		3		480		
NEW MEXICO, GAS:											
Angels Peak, San Juan—Dakota—Cretaceous sand	1947	A	6,490		1		1		40		†493,013
Barker Creek, San Juan—Dakota, Paradox—Cretaceous, Pennsylvanian, sand, limestone	1941	A	2,196-8,420						3,200		60,179,996
Blanco, Rio Arriba—Mesaverde—Cretaceous sand	1927	T	4,550								44,624,755
Blanco, South, Rio Arriba—Pictured Cliffs—Cretaceous sand	1952	T	4,550								1,248,276
Dogie Canyon, Rio Arriba—Pictured Cliffs—Cretaceous sand	1951	A									748,149
Fulcher-Basin-Kutz Canyon—Pictured Cliffs—Cretaceous sand	1929	T	1,467								71,717,084
Kutz West, San Juan—Pictured Cliffs—Cretaceous sand	1952	T									7,030,213
Largo Canyon, Rio Arriba—Pictured Cliffs—Cretaceous sand	1953	T			1		1		160		7,699
Lindrith, Rio Arriba — Dakota — Cretaceous sand	1951	T									
Pettigrew, Rio Arriba—Mancos (Tocito)—Cretaceous sand	1951	A	6,620								148,666
Rattlesnake, San Juan—Dakota—Cretaceous sand	1924	A	685								10,525,437
Ute Dome, San Juan—Dakota—Cretaceous sand	1921	Af	2,190								13,487,053
N. Chimney Rock North, San Juan—Paradox—Pennsylvanian limestone	1953	A	8,150		1		1		160		
Torrcion, Sandoval—Mesaverde—Cretaceous sandstone	1953	A	994		1		1		160		

*Legend: A—anticline; Af—faulted anticline; T—terrace; L—lenticular; Str—stratigraphic; M—monocline. †Million cubic feet. ‡Distillate.

tubing from the Paradox at 7,600 ft. This discovery is located about 20 miles west of big Barker Creek field.

Central basin fields . . . More than 1,000,000 surface acres have been proved productive of gas from the Pictured Cliffs formation and the sandstones of the Mesaverde group in the central portion of the San Juan basin. No definite delineation of the productive area has been established yet. The eastern limit especially is wide open. Within this area of stratigraphically trapped gas, which measures 55 miles long and up to 25 miles wide, there are but few drilled locations which have failed to yield commercial production.

Wells in the Pictured Cliffs formation, productive at Aztec, Kutz, and West Kutz have an average initial potential of about 750,000 cu. ft. of gas daily, but much larger wells are completed. Blanco field, which is still expanding north and east with no definite boundary established in either direction, produces from sands of the Mesaverde group. Wells in this field are completed for potentials ranging between 100,000 and 10,000,000 cu. ft. of gas daily.

Geophysical Activity

Seismograph . . . On the New Mexico side of the San Juan basin, seismic work during 1952 totaled 66 crew months as compared with 62 crew months in 1951. This work was conducted throughout McKinley, Rio Arriba, Sandoval, and San Juan counties. The greatest volume of exploratory work was conducted by Gulf Oil Corp., Humble Oil & Refining Co., Magnolia Petroleum Co., and Skelly Oil Co.

Gravimeter . . . Volume of gravimeter work in this sector dropped to 8 crew-months during 1952 and was limited to portions of McKinley and San Juan counties. This work was done by Continental Oil Co., El Paso Natural Gas Co., and Pubco Development Co.

Drilling Activity

El Paso Natural Gas Co. has been extremely active in drilling operations in the San Juan basin where this firm controls more than 500,000 acres of leases. Even during 1952 when the company's drilling program was curtailed to some extent because of drill pipe and casing shortages, 108 gas wells were drilled by the company or for its account in San Juan of which only 4 proved to be dry holes and were plugged and abandoned. For 1953, El Paso plans to drill a total of approximately 250 San Juan wells.

El Paso obtains the entire gas supply for its San Juan basin pipe-line system from dry gas fields in San Juan. At the present time the system is connected to six fields—Blanco, Fulcher-Kutz, West Kutz, Aztec, South Blanco-Dogie Canyon, and Barker Creek dome.

The firm produces a large part of the gas supply for this system from lands it controls under leaseholds, operating agreements, and farmouts, and purchases the remainder from other operators under long-term purchase contracts. During 1952, El Paso produced 54,576 M.M.c.f. of gas (measured at 14.9 psi.) from four fields in the San Juan basin, which amounts to 11.20 per cent of the company's total gas requirements throughout the West. On the other hand, El Paso purchased during the year 1952, 14,355 M.M.c.f. (measured at 14.9 psi.) from five fields in the San Juan basin under 32 gas-purchase contracts; this amounts to 11.20 per cent of the company's total gas requirements. In San Juan, average price paid by El Paso in 1952 for gas purchased (in almost all cases taken at the well head or from field separators) was about 7.84 cents per M.c.f.; in 1953, it is estimated that such average price will be about 7.94 cents per M.c.f.

Brokaw, Dixon & McKee, evaluation engineers, point out that Blanco field is by far the largest field in the San Juan basin and that the principal gas-producing horizon is the Mesaverde formation of Cretaceous age. The firm states that the Mesaverde formation has been proved productive under 560,000 acres and that future development will prove the productive area still larger.

The engineering firm estimates that the recoverable gas reserve in the Mesaverde reservoir underlying the area proven (as of January 1, 1952) to be 5,920 billion cubic feet, of which 3,171 billion cubic feet is dedicated to El Paso's system under gas-purchase contracts and through the ownership of gas leasehold rights. In the other fields in San Juan, the evaluation engineers estimate the proved gas reserves dedicated to the El Paso system are 1,423 billion cubic feet, making a total of 4,594 billion cubic feet of proven reserves dedicated to the San Juan basin system.

Total gas requirements of the San Juan basin system of El Paso through the year 1968 including requirements for increased deliveries through that system anticipated in applications now pending before the Federal Power Commission, are estimated by these engineers to be 2,444 billion cubic feet, leaving an excess of reserves above requirements of 2,150 billion cubic feet, approximately one-half of which is owned by El Paso.

During 1953, El Paso Natural Gas Co. will drill 287 wells to increase deliveries of natural gas into the company's San Juan line. During the first quarter of the year, El Paso operated seven drilling rigs (5 rotary and 2 combination) and contractors operated 15 rigs for their account. During the second quarter, 34 rigs were operating including those of contractors.

One of the leading gas-producing companies in the basin is Stanolind Oil & Gas Co. with an interest in about 300,000 acres. During the 1920's, Stanolind's predecessor, Midwest Refining Co., pioneered in this basin, bringing in the Ute Dome and Hogback fields. Six years ago, Stanolind's only gas production was about 500 M.M.c.f. of gas a year from Ute Dome. Stanolind's gas sales reached 677 M.M.c.f. annually in 1951 when Kutz Canyon field came in. In 1952, with development from more wells at Kutz and the new Blanco field, Stanolind's gas sales rose to 4,907 million cubic feet. Currently, Stanolind is operating six rigs in the San Juan basin. During 1952, the company drilled 29 wells in the basin; and during 1953 plans to drill 76 wells.

Phillips Petroleum Co. . . . This is another major operating company in San Juan basin. This firm has 14 rotary rigs in operation engaged in development of a vast spread of leases scattered throughout the basin. At present Phillips holds under oil and gas leases and options 276,338 acres in the basin. On these leaseholds, it has completed 11 gas wells. In addition, 10 wells are in process of completion. In some cases, Phillips acreage is operated by other unit operators such as Stanolind's Rosa block and the Northeast Blanco unit operated by Blackwood & Nichols.

Phillips commenced leasing in San Juan in 1949. During 1951 and 1952, the company conducted extensive geological work throughout southwestern Colorado and Northwest New Mexico. In the Gobernador area on the east side of the basin, Phillips drilled three shallow stratigraphic tests to the Pictured Cliffs gas sand.

Acreage ownership . . . Acreage ownership in San Juan is principally federal or public land; however, various Indian tribes hold extensive acreage throughout the basin.

An example of the distribution of

lease holdings of principal operators is afforded in the Blanco Area Development Contract covering agreements with the U. S. Geological Survey in San Juan and Rio Arriba counties, New Mexico. Federal acreage covered under this contract number as follows: El Paso Natural Gas Co. 100,974.25 acres; Delhi Oil Corp. 20,922.15 acres; Southern Union Gas Co., 11,863.45 acres; Western Natural Gas Co., 9,742.95 acres; Stanolind Oil & Gas Co., 9,051.20 acres; Aztec Oil & Gas Co., 7,229.09 acres; and Sunray Oil Corp., 6,022.21 acres, total 165,805.30 acres.

Leasing . . . Fourth and last sale completed at Window Rock Indian Agency sale brought the cumulative bonuses for all sales of leases on the Navajo tribal lands to $4,291,179.38. In all, 364,598 acres of the 527,302 acres were leased for an average bonus of $11.77 per acre. Highest price paid was $129.99 per acre bid by Shell Oil Co. at the sale of Block "B."

At this May 22, 1953, sale, 29 of the 49 tracts offered were leased with an average bid of $7.11 per acre. Highest bid was by Ohio Oil Co. for bonus of $31.33 per acre, a 2,560-acre block in 43s-21e, San Juan County, Utah. Other successful bidders were Bolack Oil & Gas Co., Gulf Oil Corp., Humble Oil & Refining Co., Kerr-McGee Oil Industries, Inc., Murphy Corp., Shell, Sunray Oil Corp. Sinclair Oil & Gas Co. and Skelly Oil Co. were joint bidders.

Drilling practices . . . Current practices employed by contractors in San Juan basin employ drilling with water to the Pictured Cliffs sandstone, except where lost circulation is common or where high-pressure gas is found in the Fruitland sandstone.

In a few cases, Mesaverde sandstone wells have been drilled to casing point with water as a drilling fluid but the sloughing action of Lewis shale section when contacting water makes this generally impracticable. However, during the past 2 years, very few wells have been drilled to the Mesaverde using ordinary drilling fluids. Lost-circulation conditions in the Mesaverde group has brought about a complete switch to gas drilling wherever this objective is sought.

Gas processing . . . El Paso Natural Gas Co. has two sources of gas in San Juan. Each source requires a different method of gas processing which is conducted at the company's San Juan River plant which combines gas-treating and natural-gasoline facilities.

Combination of the various units in this plant permits El Paso Natural to take gas from Barker dome field, remove the components that make this gas unsuitable for direct use, then mix the sweetened gas with Blanco field gas from which valuable liquid products have been removed. Finally, the mixed gas stream is transmitted through El Paso's transmission system with a minimum of trouble.

Barker Dome field gas contains approximately 1 per cent hydrogen sulfide and 15 per cent carbon dioxide. Specifications for the gas entering the company's pipe lines allow a maximum of 0.25 grains of hydrogen sulfide per 100 cu. ft. In order to meet this requirement, it is necessary to remove virtually all of the hydrogen sulfide present in the raw gas. Moreover, it is also necessary to raise the B.t.u. on this gas and this is brought about through the removal of carbon dioxide.

Hydrogen sulfide and carbon dioxide are removed by contacting the gas with a solution containing monoethanolamine, diethylene glycol, and water. Monoethanolamine reacts with hydrogen sulfide and carbon dioxide causing them to be retained in the solution, while the diethylene glycol serves as a dehydrating agent to remove much of the water vapor from the gas.

Gas produced from Blanco gas field is free of hydrogen sulfide and the carbon dioxide content is low. Therefore, it is not necessary to treat this gas in the same manner as the gas from Barker dome. Blanco gas contains sufficient natural gasoline, butane, and propane to make it economical to remove these products.

Gasoline extraction . . . In the El Paso natural gasoline plant at San Juan River the design capacity of the main absorber is 70 million standard cubic feet per day at 835 psig. Vapors from the deethanizer reflux accumulator and the recompressor condensate separator are handled by the high-pressure reabsorber. The recompressor unit processes vapors from the high-pressure-still top-product accumulator. The low-pressure reabsorber handles vapors from the low-pressure rich-oil flash tank.

The two stills operate in series to strip the products from the absorption oil. The high-pressure still operates at 130 psig., the low-pressure still at 30 psig.

Since the main absorber operates at 835 psig., and Blanco field gas line pressures are 500 psig., it is necessary to compress the gas. Compression is obtained with four 1,100-hp. gas engines driving reciprocating compressors; these engines also drive the recompressors for the gasoline plant.

Dehydration plant . . . After the two gas streams have passed through their respective plants, they are mixed and sent to the dehydration plant. This plant consists of two horizontal dry beds each containing 80,000 lb. of dry desiccant. Vessel piping permits one bed of desiccant to be in service while the other bed is being regenerated. Regeneration is brought about by passing hot gases through the beds to heat the desiccant and drive out the water.

These beds also act as an amine-recovery unit to remove amine vapors that have been picked up by the Barker dome gas in the MEA-DEG treating plants. Amine is recovered with water by passing regenerating gas from dehydration beds through a cooler and condensing the water and amine. Water and amine are returned to the treating plant through the still reflux system.

Natural-gasoline plants . . . The first modern-design natural-gasoline plant in the basin was placed in operation in May 1949 by Southern Union Gas Co. It is an absorption type with daily capacity of 40 M.M.c.f. Gas source is the main pipe line of the Albuquerque-Santa Fe area with principal plant volumes originating in Kutz Canyon-Flucher Basin field. The plant processes about 20,000 gal. of products daily including 10,000 gal. of 12-lb. R.v.p. gasoline, 4,000 gal. of butane, and 6,000 gal. of propane.

Gas storage . . . Underground storage of natural gas was commenced in the Barker Creek dome Dakota sand (Cretaceous) reservoir at Barker Creek dome during 1947 by Southern Union Gas Co. At the time of initial injection, well head pressures were set at 600 psi. and injected volume was 6.0 M.M.c.f. of gas per day into 10 wells. Currently, injection pressure is in excess of 750 psig. and the daily injection rate is about 8.5 M.M.c.f. into 13 wells.

Refining . . . Malco Refineries, Inc., of Prewitt, N. M., operates a 2,500-bbl. capacity refinery at Prewitt.

Arex Co. placed in operation in May 1953 a new unit at Bloomfield, N. M., with crude-oil charging capacity of 750 bbl. per day.

Continental Oil Co. operates refinery at Farmington with crude-oil charging capacity of 833 bbl. per day. Crude oil source is from Hogback, Rattlesnake, and Table Mesa fields.

Oriental Refining Co. operates a 1,000-bbl. per day crude-oil refinery at Alamosa, Colo.

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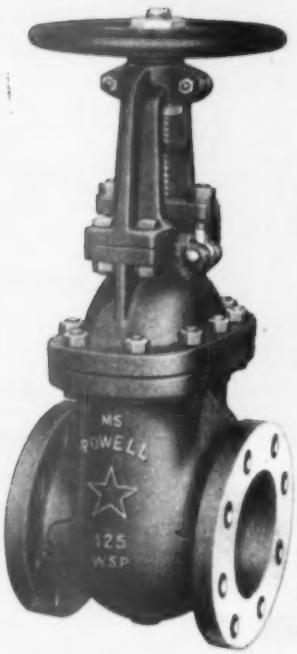

Fig. 1793—125-pound Iron Body Bronze Mounted Gate Valve with tapered solid wedge. Made in sizes 2" to 30", inclusive.

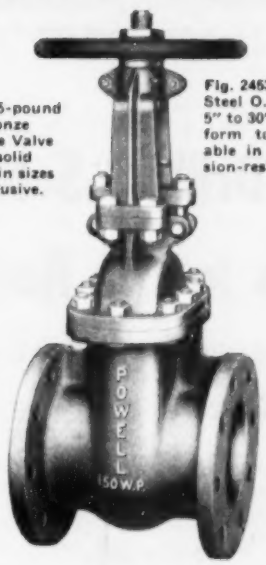

Fig. 2453-G — 150-pound Stainless Steel O. S. & Y. Gate Valve. Sizes 5" to 30", incl. All dimensions conform to latest standards. Available in a variety of other corrosion-resisting metals and alloys.

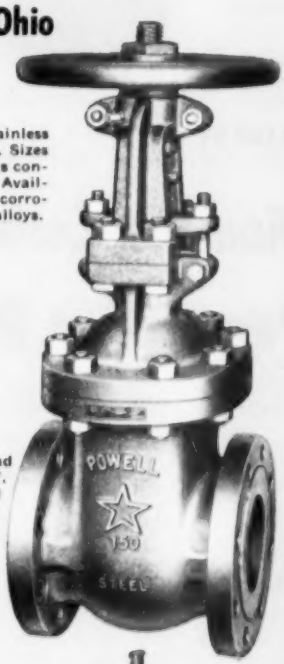

Fig. 1503—150-pound Cast Steel O. S. & Y. Gate Valve. Flanged ends and tapered solid wedge.

DEPENDABLE VALVES SINCE 1846

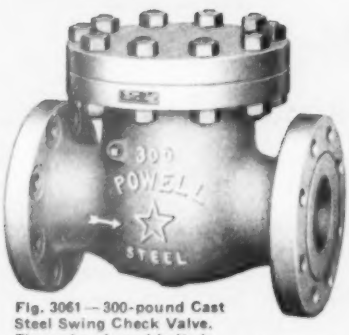

Fig. 3061—300-pound Cast Steel Swing Check Valve. Flanged ends and bolted cap. Disc has ample lift to permit full, straight-way, unobstructed flow through the valve body.

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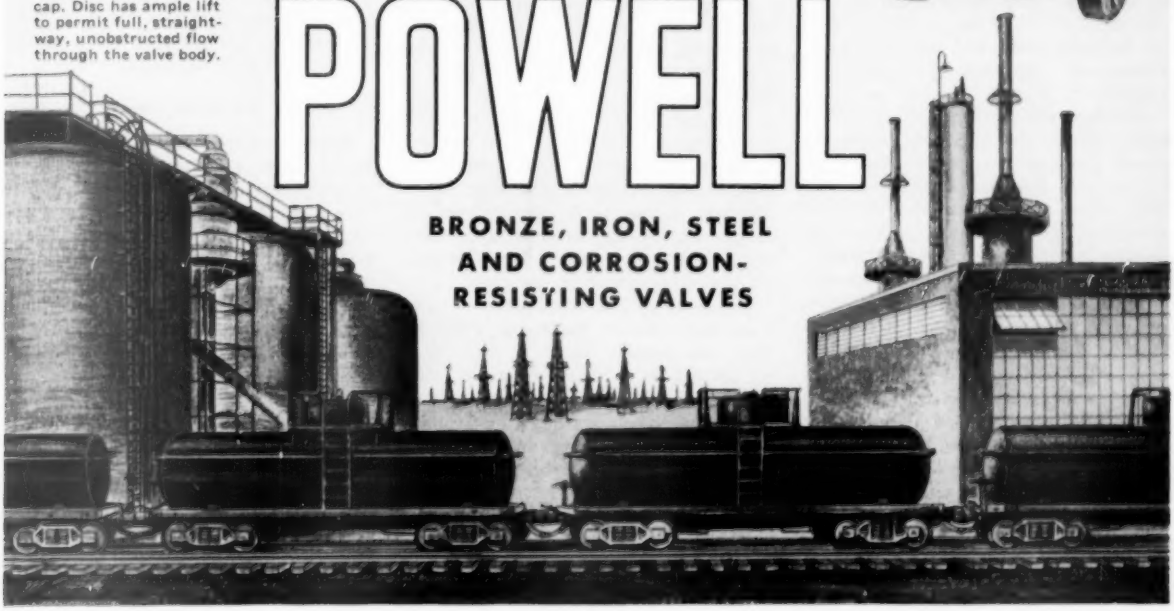

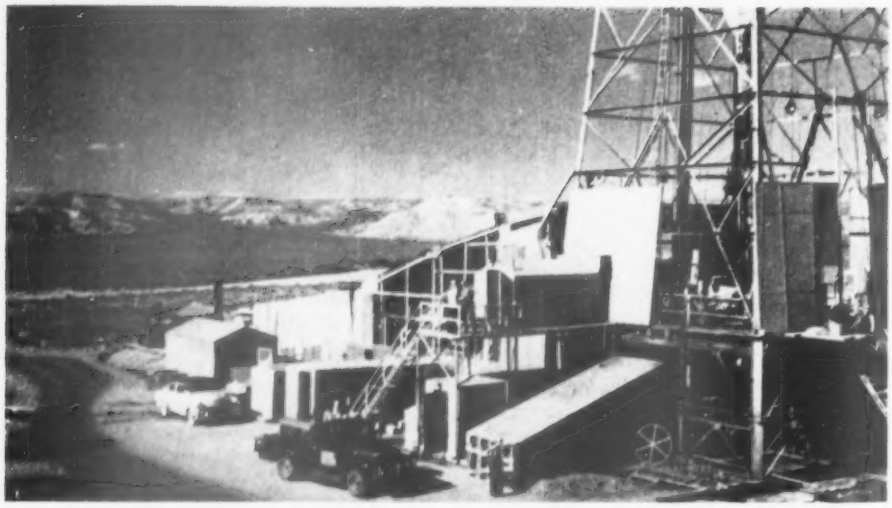

TYPICAL DEEP-DRILLING RIG in Beaver Creek field, Fremont County, Wyoming.

BASIN BY BASIN

Diamond Coring and Drilling Solve Many Penetration Problems in the Rockies

Diamonds efficient in cutting highly fractured Permo-Pennsylvanian rocks.

by Tom Manuel

AS the search for oil requires deeper drilling and incurs increasingly difficult operating conditions, use of diamonds in the industry is expanding both as a coring tool and straight drilling tool. To help solve some of the new and difficult coring problems, special diamond heads and operating techniques are continuously being developed.

Although most of the coring in the Rocky Mountain region presents no special problems, it usually calls for the use of diamond heads. On the other hand, certain sections are very difficult to diamond core. Even though some of the highly fractured, extremely hard Permian and Pennsylvanian sections are difficult and costly to diamond core, the use of diamonds is often a more economical and efficient method of drilling than rock-bit drilling.

Within the past year, solid diamond drilling bits have proved to be useful drilling tools in all of the Rocky Mountain basins. These drilling bits have even been designed to give better samples than rock bits in extremely hard formations and will replace some diamond coring where used mainly for penetration.

Diamond coring has played a very important part in Rocky Mountain drilling and will continue to do so.

Williston Basin

Full-gage diamond-head coring is used by most operators in the Williston basin. As about 90 per cent of the drill-stem testing done in the basin is full-hole testing, it is desirable to cut a full-gage hole. In most instances, it is believed that the packer will set better in a hole cut with a diamond head than a rock-bit-drilled hole. Also, full-gage coring saves considerable rig time over 6⅛-in. coring and reaming down with a rock bit in the Mississippian sections cored in the basin.

Diameter of the diamond head most frequently used in the basin is 8⅞-in. This size usually allows a 9-in. rock bit to follow without reaming; and, consequently, this size diamond head will follow a 9-in. rock bit. Penetration rates for this size diamond head vary from 2 to 9 ft. per hour. An over-all average of about 3 ft. per hour can be expected.

The practice of alternating diamond-core heads on continuous coring programs is commonly used by operators in the basin. This helps keep the bits out to gage and the hole out to size. Coring recoveries are good throughout the basin, and there are few very serious coring problems in most wells. Diamond-head coring costs for 8⅞-in. heads is approximately $9 per foot, provided the bits are worn out normally and are not junk damaged.

Big Horn Basin

Since the producing zones of the Big Horn basin are found in sediments ranging from Cretaceous to Mississippian age, coring conditions vary greatly throughout the basin and even in different formations of each well. Much of the diamond coring in the basin presents no great problems; however, some of the most difficult diamond-head coring conditions in the Rocky Mountains exist here.

Triassic red beds often exhibit a slow rate of diamond-coring penetration. Permian formations (Phosphoria and Embar) are comprised of highly fractured and extremely hard cherty limes and dolomites; this lithology is conducive to poor core recoveries and damaged diamond heads. Toxic hydrogen sulfide gas is frequently encoun-

Diamond-Core Data in Rocky Mountain Basins

WILLISTON BASIN—Empire Oil Co. 1 Hathaway, Dawson County, Montana

Diam. (in.)	No. cores	Interval	Total feet	Recovery		Coring performance		Weight on bit (lb.)	Rotary table speed (r.p.m.)	Pump pressure (psi.)	Fluid volume (g.p.m.)
				Feet	Per cent	Hours	Ft./hr.				
Mississippian Madison lime (hard lime, dolomite, shale, anhydrite, chert):											
8⅞	16	8,600-9,562	962	962	100	222	4.35	8,000-10,000	50-70	750-950	310-330

BIG HORN BASIN—Socony-Vacuum Oil Co., F-22-20-Government, Manderson Field, Big Horn County, Wyoming

Diam. (in.)	No. cores	Interval	Total feet	Recovery		Coring performance		Weight on bit (in.)	Rotary table speed (r.p.m.)	Pump pressure (psi.)	Fluid volume (g.p.m.)
				Feet	Per cent	Hours	Ft./hr.				
Triassic Chugwater (red beds):											
8¾	3	7,076-7,147	71	69	92.6	45	1.56	10,000-15,000	50-70	900-1,000	300 +
Triassic Dinwoody (shale):											
8¾	3	7,147-7,227	80	80	100	65	1.23	10,000-15,000	50-70	900-1,000	300 +
Permian Phosphoria (dolomite and limestone):											
8¾	6	7,227-7,303	76	72	99	63	1.20	10,000-15,000	50-70	900-1,000	300 +
6⅛	4	7,303-7,495	192	192	100	166	1.27				
Pennsylvanian Tensleep (extremely hard sand):											
6⅛	4	7,495-7,619	124	124	100	73	1.70	12,000-16,000	60-90	900-11,000	200-300 +
Pennsylvanian Amsden (sand):											
6⅛		7,619-7,853	234	232	99	140	1.67				
Mississippian Madison (limestone):											
6⅛		7,853-8,080	227	220	97	210	1.41	6,000-12,000	40-70	800-1,000	180-250 +
Total	20	7,076-8,080	1,004	989	99	762	1.31				

DENVER-JULESBURG BASIN—Sherrod & Apperson No. 2 County, Weld County, Colorado

Diam. (in.)	No. cores	Interval	Total feet	Recovery		Coring performance		Weight on bit (lb.)	Rotary table speed (r.p.m.)	Pump pressure (psi.)	Fluid volume (g.p.m.)
				Feet	Per cent	Hours	Ft./hr.				
Lower Cretaceous Dakota "D" and "J" (sand and shale):											
7¾	2	6,397-6,408	11	6	55	5½	2	10,000-16,000	50-85	6,000-8,000	320
		6,465-6,514	49	49	100	5	10				

UINTA BASIN—Sun Oil Co. 1 South Ouray, Uintah County, Utah

Diam. (in.)	No. cores	Interval	Total feet	Recovery		Coring performance		Weight on bit (lb.)	Rotary table speed (r.p.m.)	Pump pressure (psi.)	Fluid volume (g.p.m.)
				Feet	Per cent	Hours	Ft./hr.				
Tertiary zones, Green River shale:											
6⅛	7	1,998-2,266	266	266	100	50	5.33	6,000- 9,000	50-70	400-500	200 +
8⅞	57	*2,280-4,583	2,808	2,808	100	976	2.98	10,000-22,000	50-70	500-750	400 +
8⅝	17	*4,583-6,356	891	891	100	272	3.28	10,000-16,000	50-60	500-750	400 +
Total	81	1,998-6,356	3,965	3,965	100	1,298	3.4				

*Drilled in part.

SAN JUAN BASIN—Coring with Gas Operation

Diam. (in.)	No. cores	Interval	Total feet	Recovery		Coring performance		Weight on bit (lb.)	Rotary table speed (r.p.m.)	Pump pressure (psi.)	Fluid volume (g.p.m.)
				Feet	Per cent	Hours	Ft./hr.				
Cretaceous (sandstones and shales):											
6⅛	4	5,363-5,508	145	111	76.5	18	8.05	10,000-18,000	40	*300-400	
6⅛	10	5,508-5,806	298	269	90	25½	11.7				
6⅛	4	5,806-5,907	99	93	94	10½	9.4				
Total	18	5,363-5,907	542	473	87.5	54	10.0				

*Gas pressure.

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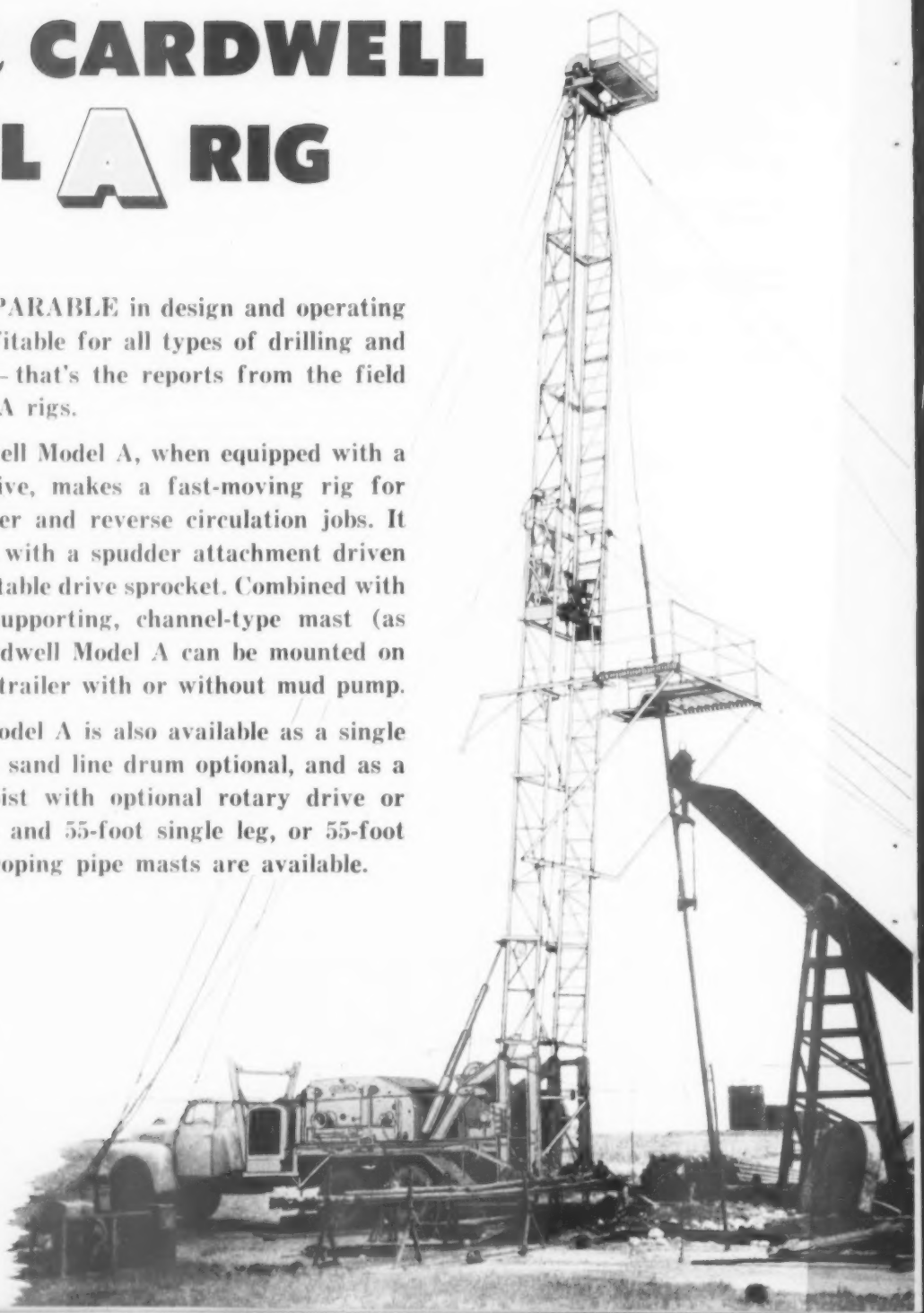

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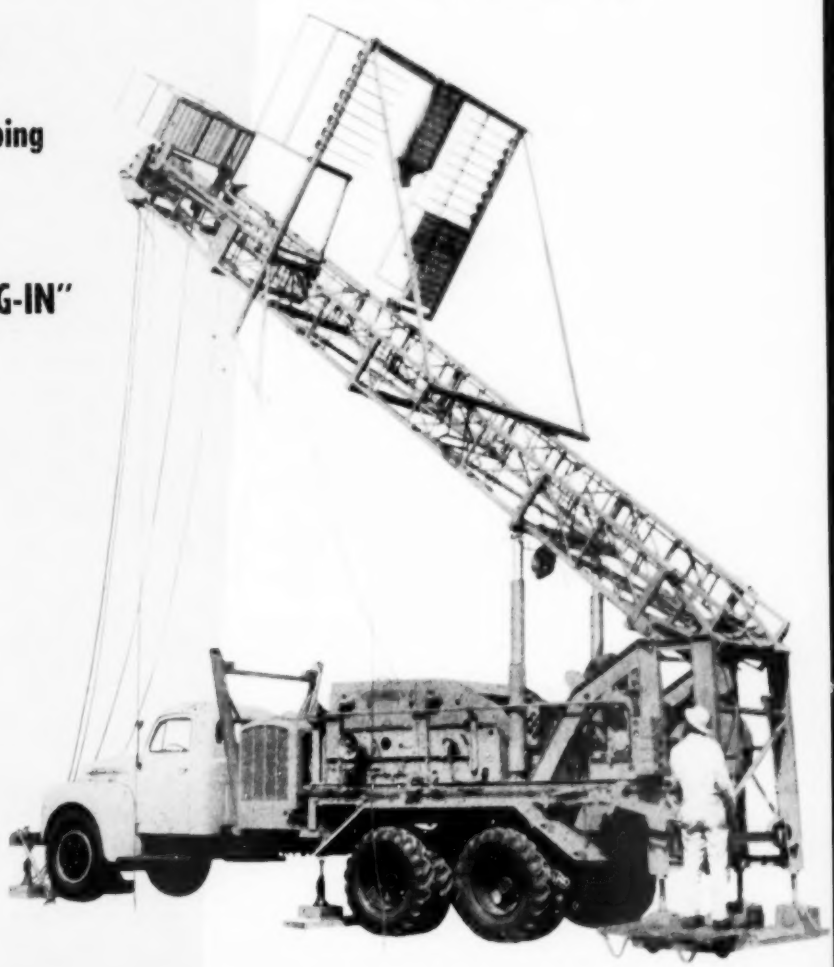

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POWDER RIVER BASIN—American Liberty Oil Co., 16 Federal, Johnson County, Wyoming[1]

Diam. (in.)	No. cores	Interval	Total feet	Recovery		Coring performance		Weight on bit (in.)	Rotary table speed (r.p.m.)	Pump pressure (psi.)	Fluid volume (g.p.m.)
				Feet	Per cent	Hours	Ft./hr.				
Cretaceous Second Frontier:											
8¾	2	2,005-7,024	19	19	100	4	5				
Permian Embar (limestone and anhydrite):											
8¾	4	9,105-9,131 9,183-9,331	226	219	96.5	86	2.5				
Pennsylvanian Tensleep:											
8¾	1	9,331-9,364	33	33	100	11	2.9				
Total	7	9,331-9,364	278	271	98	101	2.7				

George J. Greer 3 Kendrick, Big Horn County, Wyoming[1]

Diam. (in.)	No. cores	Interval	Total feet	Recovery		Coring performance		Weight on bit (lb.)	Rotary table speed (r.p.m.)	Pump pressure (psi.)	Fluid volume (g.p.m.)
				Feet	Per cent	Hours	Ft./hr.				
L. Cretaceous, U. Jurassic-Kootenai-Morrison sands and soft shales:											
6⅛	2	3,570-3,607 2,650-3,672	59	37	63.8	15.5	3.8	6,000-10,000	50-70	400-600	200+
Pennsylvanian Tensleep (hard sd.):											
6⅛	3	4,615-4,706	91	83	91.2	4	2.2	10,000-16,000	70-80	500-800	200+
Pennsylvanian Amsden (sand):											
6⅛	7	4,706-4,982	176	174½	99	58.5	3				
Mississippian Charles (limes and sand):											
6⅛	4	4,982-5,175	193	193	100	57	3.4	7,000-12,000	60-80	600-850	200+
Mississippian Mission Canyon (limestone):											
6⅛	7	5,472-5,730	258	257	99	83	3.10	7,000-12,000	60-80	600-850	200+
Mississippian Lodgepole (limestone):											
6⅛	1	6,254-6,293	39	39	100	15	2.8	7,000-12,000	60-80	600-850	200+
Devonian (limestone):											
6⅛	6	6,293-6,486	193	184	99	60	3.2	7,000-12,000	60-80	600-850	200+
Ordovician (limestone and shale):											
6⅛	7	6,486-6,763	277	276	99	89	3.11	8,000-14,000	70-80	700-800	200+
Cambrian (limestone and shale):											
6⅛	1	6,763-6,808	45	45	100	15.5	2.9				
Total	38	6,763-6,808	1,331	1,288½	96.7	44.2	3.1				

WIND RIVER BASIN—Far West Oil Co. 1 Government, Fremont County, Wyoming

Diam. (in.)	No. cores	Interval	Total feet	Recovery		Coring performance		Weight on bit (in.)	Rotary table speed (r.p.m.)	Pump pressure (psi.)	Fluid volume (g.p.m.)
				Feet	Per cent	Hours	Ft./hr.				
Cretaceous First and Second Frontier (sandstone):											
6⅛	2	950-1,022	72	72	100	18¾	3.82	8,000-14,000	40-70	350-550	200
Cretaceous Third Frontier (sandstone):											
6⅛	1	1,465-1,495	30	28	93.5	4	7.5	8,000-14,000	40-70	350-550	200
Cretaceous Second Frontier (fine sand and shale):											
6⅛	3	1,156-1,208	52	52	100	12	4.3	8,000-14,000	40-70	350-550	200
Cretaceous Fourth Frontier (dark shale and sand):											
6⅛	3	1,487-1,517 2,140-2,152	42	39	95	10	4.2	8,000-14,000	40-70	350-550	200
Cretaceous Muddy (sandstone):											
6⅛	2	2,219-2,227 2,538-2,573	43	22	49	13½	3.26	8,000-14,000	40-70	350-550	200
Triassic Alcova (limestone) top Dinwoody shale (red shale and anhydrite):											
6⅛	1	4,490-4,495	5	5	100	4½	1.1				
Permian Phosphoria (dolomite and limestone):											
6⅛	15	4,560-4,944	384	375	96.6	206	1.86				
Pennsylvanian Tensleep (sandstone and limestone):											
6⅛	3	4,975-5,059	84	93	98.8	33	2.54				
Total	30	4,975-5,059	717	676	94.5	301.5	2.36				

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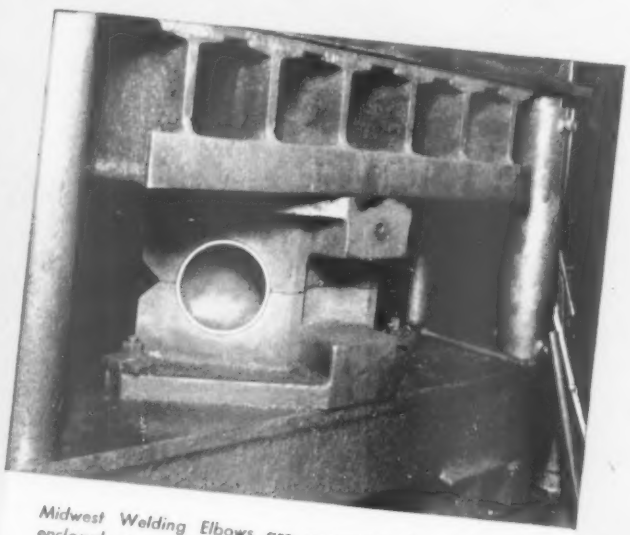

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MIDWEST WELDING FITTINGS Improve Piping Design and Reduce Costs

THE AUTHOR

Tom Manuel is field engineer at Fort Morgan, Colo., for Christensen Diamond Products Co. His field experience with that organization has taken him into all of the oil basins of the Rocky Mountain region with the exception of Williston and San Juan. After serving with the Armed Forces, he attended Montana School of Mines. On graduation with a bachelor's degree in petroleum engineering, he joined the Christensen firm at Salt Lake City, from which point he worked the Uinta basin.

tered in these Permian formations. Certain sections of Pennsylvanian formations (Tensleep and Amsden) are extremely hard as well and often are fractured.

Diamond coring is conducted in the Big Horn basin both for information and penetration-rate improvement. Diamond-head-diameter sizes used throughout the basin range from 4¾ to 8⅞-in. —usually in the following order: 8⅞, 6⅛, and 7¾-in. o.d. Operating conditions and procedures are governed by the most economical rate of penetration and core recovery. Drilling bortz is the grade of diamonds most generally set in heads used in the Big Horn basin.

Denver-Julesburg Basin

Although the majority of the wells in the Denver-Julesburg basin are diamond cored, the total footage cored per well usually does not exceed 50 ft. Most coring in the basin is confined to the Dakota "D" and "J" sands. However, there are few operators who core exploratory wells extensively. Also, recent discoveries in the Lyons (Permian sand) require more diamond coring.

Most of the diamond coring in the Denver-Julesburg basin presents no serious or unusual problems. In the northern part of the basin some nonpyrite crystals are found in the Dakota which often damage diamond heads. The high percentage of shale in the sections cored often slow up the rate of penetration.

Most of the operators prefer to use a 6⅛-in. diamond head. This allows drill-stem testing in the small rathole. Reaming down at rates running from 10 to 50 ft. per hour with a 7⅞-in. or 9-in. rock is quite easily done. The second most popular size diamond core head in the basin is 7¾-in. Advantage accruing from use of this size include saving of reaming time and in a good sand, the rate of penetration for 7⅞-in. head approximately that of a 6⅛-in. head.

Penetration rates ran from 1 minute to 60 minutes per foot for a 6⅛-in. diamond head with an average rate being about 10 minutes per foot for sand and about 20 to 35 minutes per foot for shale. Rates of penetration for a 7⅞-in. core head vary from 3 to 60 minutes per foot with an average rate of 14 minutes per foot for sand and 25 to 30 minutes per foot for shale.

Operating procedures vary widely throughout the basin with different operators. However, 6⅛-in. diamond heads are run generally under these operating conditions: 8,000 to 10,000 lb. of weight, 50 to 80 r.p.m. rotary-table speed, 180 to 200 g.p.m. fluid volume, and 350 to 900 psi. pump pressure. Larger 7¾-in. diamond-heads are run with from 10,000 to 20,000 lb. weight, 40 to 70 r.p.m. rotary-table speed, 200 to 350 g.p.m. fluid volume, and 400 to 1,000-psi. pump pressure. In certain instances, where required by formation conditions (such as hardness or fractures), weight on the heads have been increased as much as 200 per cent. This practice may be expected to shorten the life of the diamond head.

Average footage on diamond heads used in the basin varies between 300 and 400 ft. Costs per foot for 6⅛-in. diamond heads range from $1.30 to $8 per foot with the average probably being between $4 and $5. Costs for 7¾-in. diamond heads have run from

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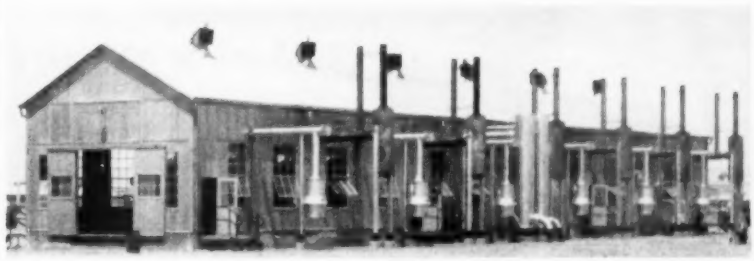

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$3.60 to $12 per foot with the average probably being between $6 and $7. These costs are based on diamond loss from ordinary wear.

In the Denver-Julesburg basin, because of the soft crumbly shales, core recovery is sometimes poor. By using better core catchers and using extreme care while coring and breaking off the core, operators have been able to reduce core losses considerably.

Uinta Basin

Considerable exploratory drilling has been conducted in the past few years in the Uinta basin of northeast Utah and northwest Colorado. Composed mostly of Tertiary sediment (Uintah and Green River shales), the basin also has Triassic and Pennsylvanian production. Rangely field, where oil-well diamond-head coring first proved to be successful in the Pennsylvanian Weber sandstone, lies in the eastern edge of the basin. Diamond heads (6⅛-in. diameter) used in Rangely have cored as much as 2,000 ft. at rates between 5 and 15 minutes per foot. In other parts of the basin diamond coring is more difficult because the Green River shales are very tough and sometimes highly fractured. In spite of the high percentage of fractured shale, core recoveries are good. However, this fractured condition often wedges the core barrel and prevents filling the core barrel with a full core.

Operators have found that full-gage coring is less expensive than coring with 6⅛-in. heads because of the saving in rig time required to ream down a 6⅛-in. hole. The most popular size diamond head used in the Uinta basin is 8⅞ by 4-in. This size diamond head can be alternated usually with 9-in. rock bits, and also allows the use of a 6¾-in. core barrel which can be washed over in a 9-in. hole. Another reason for full-gage coring is that 90 per cent of the drill-stem tests are full-hole size.

One operator diamond cored more than 15,000 ft. last year using 8⅞-in. diamond heads at a head cost of $7.84 per foot. Diamond-head (using heads set with Congo diamonds) costs in the Red Wash area run between $1.65 and $9 per foot, and average about $4 per foot for 8⅞-in. heads. Coring is usually for information. But diamond coring for penetration is not uncommon.

San Juan Basin

Since production in the San Juan basin consists principally of low-pressure gas from Triassic sands, a new method of completing wells by drilling in with gas has been developed in this basin.

In conjunction with gas drilling, considerable diamond coring has been done using gas as a drilling fluid. Using a 6⅛ by 2⅝-in. diamond-core head on one well, pressures ranging from 175 to 200 psi. were found to be insufficient to clear cuttings and allowed the diamond core head to mud up and wear out after cutting 28 ft. of core in 5 hours. Using gas, pressures ranging from 300 to 500 psi. operators obtain from 200 to 600 ft. on diamond-core heads with rates of penetration varying from 6 to 30 ft. per hour.

With gas coring, diamond-core-head costs per foot have ranged from $2 to $30 per foot. However, under normal or average drilling conditions, diamond bit cost per foot can be expected to run from $2 to $5 for 6⅛-in. diamond core heads.

In contrast, costs of diamond coring with regular drilling fluid are higher, ranging from $4 to $10 per foot. Rates of penetration are also slower, running from 2 to 10 ft. per hour. Five feet per hour would be considered a good rate of penetration.

When coring with gas, the weight on the diamond head is usually higher (10,000 to 18,000 lb.) than coring with a regular drilling fluid (6,000 to 14,000 lb.)

Powder River Basin

Powder River basin of Wyoming presents the fewest problems in diamond-coring mainly because most of the basin's production is from Cretaceous formations which are very adeptive to diamond coring. Core recovery in these sections average better than 97 per cent. Rates of penetration for 6⅛-in. diamond coring, which comprises at least 70 per cent of the coring done in the basin, average between 4 and 5 ft. per hour.

Pennsylvanian Tensleep formation is considered the most difficult of all sections to diamond core in the basin. This extremely hard, fractured sandstone often damages diamond heads within a short period of time.

Most of the coring done in the basin is for geological information. Procedures vary with each operator. However, generally 6,000 to 12,000 lb. of weight, 60 to 70 r.p.m. rotary table speed, and about 200 g.p.m. of fluid over the diamond head are used when running a 6⅛-in. head. Costs vary from as little as $2 to $12 per foot.

Wind River Basin

Like the Big Horn basin, diamond coring in the Wind River basin, presents many problems below the Cretaceous formation. In most Cretaceous sections of the basin, penetration rates and core recoveries for diamond-head coring are excellent. Rates of penetration for a 6⅛-in.-diameter diamond head should average about 5 ft. per hour in the Cretaceous sections, a core

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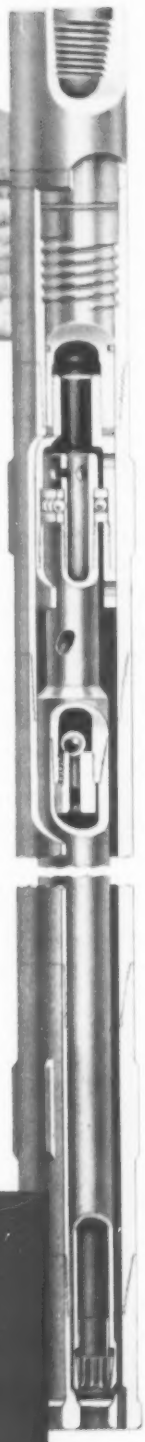

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recovery of at least 95 per cent may be expected.

Although slow and costly, diamond-head coring in this basin often affords a more rapid way to make hole than by drilling with rock bits, and in the long run is cheaper. A number of solid diamond drilling bits have been used quite effectively to speed up penetration rates. This is accomplished mainly by cutting down on trip time, as the diamond drilling bit will remain on bottom much longer than a regular rock bit. One diamond drilling bit stayed in the hole 15 days making 772 ft. in Triassic red beds.

There is about the same amount of full-hole coring done as 6 1/8-in. coring. Diamond heads with a diameter of 1/8-in. under the rock bit size can often be alternated with rock bits in the Cretaceous formations. However, below Triassic formations, a diameter of 1/16-in. under the rock bit size must be used to alternate diamond heads with rock bits.

Data Sources

1. Big Horn basin—Dean Fox, Pegasus division, Socony-Vacuum Oil Co., Inc., Casper, Wyo.

2. Wind River basin—William H. Curry, vice president, Far West Oil Co., Casper, Wyo.

3. Powder River basin—W. I. Durant, division superintendent, American Liberty Oil Co., Dallas.

4. Powder River basin (3. Kendrick)—George J. Greer, Billings, Mont.

5. Uinta basin—J. A. Praether, production manager, Rocky Mountain division, Sun Oil Co., Denver.

National Motor-Gasoline Survey, Winter 1952-53

by O. C. Blade*

THE Bureau of Mines semiannual survey report on motor gasolines shows that the average octane numbers during the winter 1952-53 were 90.9 (research) and 82.7 (motor) for premium motor fuel. For the regular gasolines, the research method number was 84 and motor method number was 79.1. Some comparative figures are given in Table 1.

The information listed in the Bureau of Mines report is the latest in a series made in cooperation with the American Petroleum Institute. It is based on analyses of 4,397 samples of gasoline collected from service stations throughout the country. The samples represent the products of 130 companies, large and small, which manufacture and supply motor gasoline.

Tabulation of octane numbers has been made according to 17 marketing areas (districts) into which the country is divided. Table 2 shows by districts the average research method and motor method octane numbers of regular and premium gasolines sold during the winter of 1952-53.

In addition to octane numbers, the samples were tested for gravity, corrosion, per cent sulfur, gum and tetraethyl lead content, Reid vapor pressure, and distillation temperatures. Results of these tests are given in the Bureau of Mines publication, R.I. 5000, "National Motor-Gasoline Survey, Winter 1952-53."

*Petroleum chemist, U. S. Bureau of Mines, Petroleum Experiment Station, Bartlesville, Okla.

TABLE 1—COMPARING OCTANE NUMBERS OF MOTOR GASOLINES, 1949-53

	Premium Oct. No.		Regular Oct. No.	
	Research method	Motor method	Research method	Motor method
Winter 1952-53	90.9	82.7	84.0	79.1
Summer 1952	90.6	82.2	83.6	78.4
Winter 1951-52	90.0	82.0	83.1	78.1
Summer 1951	89.7	81.7	82.5	77.6
Winter 1950-51	90.3	82.5	83.7	78.8
Summer 1950	90.0	82.0	83.5	78.2
Winter 1949-50	89.0	81.2	82.4	77.1

TABLE 2—OCTANE NUMBERS BY DISTRICTS WINTER 1952-53

Dist.	Research method		Motor method	
	Premium	Regular	Premium	Regular
1. Northeast area: Me., Mass., N. H., Vt., and northern N. Y.	92.3	87.4	83.2	81.3
2. Mid-Atlantic Coast region: R. I., Conn., N. J., Del., Md., Va., central and southern N. Y., and eastern Pa.	92.2	86.8	83.1	71.3
3. Southeast area: N. C., S. C., Ga., Fla., Ala., and eastern Tenn.	91.8	85.6	83.0	80.4
4. Appalachian area: Ohio, W. Va., western N. Y., western Pa., eastern Ky., and a small portion of Md.	91.8	86.9	82.9	80.5
5. Michigan	91.7	86.2	82.9	80.2
6. North Illinois area: Northern Ind., northern Ill., eastern Iowa, and Wis.	90.3	83.9	82.8	79.2
7. Central Mississippi area: Western Ky., southern Ind., southern Ill., and eastern Mo.	90.2	84.0	82.8	79.7
8. Lower Mississippi area: Miss., La., eastern and southern Ark., and western Tenn.	91.7	85.3	83.6	80.1
9. North Plains area: Minn., N. D., and S. D.	90.0	83.4	83.1	78.8
10. Central Plains area: Neb., central and western Iowa, northwestern Mo., and northern Kans.	89.9	83.2	82.9	79.0
11. South Plains area: Southern Kans., southwestern Mo., western Ark., Okla., and northern Tex.	90.7	83.2	83.0	79.1
12. Southern Texas	91.4	84.2	84.6	81.6
13. South Mountain States: Southwestern Kans., Panhandles of Okla. and Tex., western Tex., N. M., Colo., Utah, Ariz., Nev., and eastern Calif.	89.2	80.8	81.8	77.2
14. North Mountain States: Wyo., Mont., Idaho, eastern Wash., and eastern Ore.	90.0	81.4	81.1	76.3
15. Pacific Northwest: Western Wash., and western Ore.	90.8	81.7	82.2	76.9
16. Northern California	91.1	82.2	81.7	76.6
17. Southern California	90.4	81.5	81.9	76.9
National average	90.9	84.0	82.7	79.1

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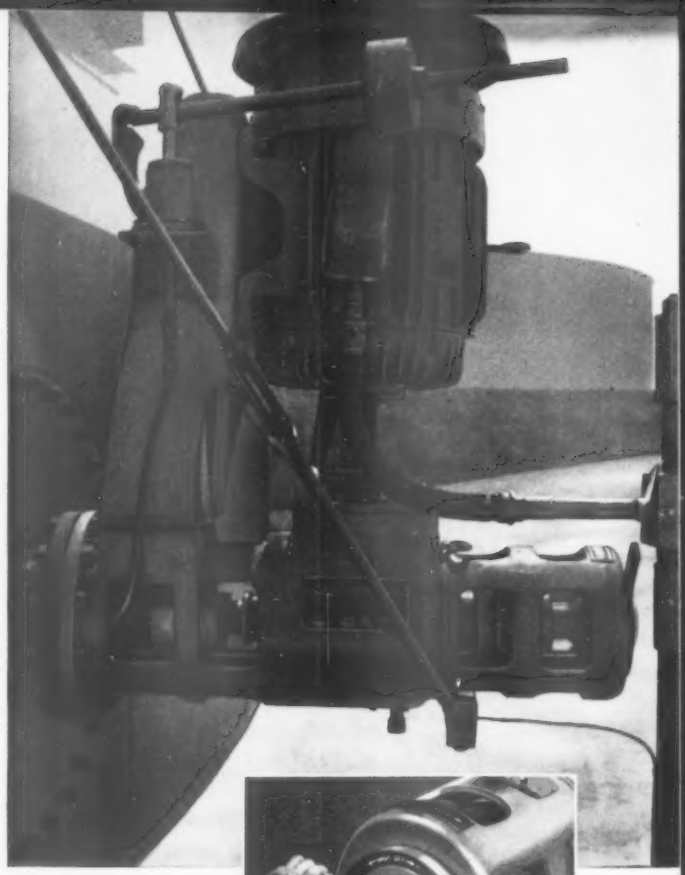

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Separating Asphalt Materials . . . N-Butanol-Acetone Method

by R. N. Traxler* and H. E. Schweyer†

A procedure has been developed which employs the solvent action of n-butanol and acetone to separate asphaltic materials into: (1) asphaltics, (2) paraffinic oils, and (3) cyclic oils. The amount of each fraction together with the refractive index of the fluid components describe the nature of the asphalt and offer valuable information concerning the behavior of the material.

This new series in Refiner's Notebook will cover:

1. Procedure for determining refractive index of asphalt materials so dark colored or viscous as to preclude direct readings.

2. Relation between density and refractive index and between density and carbon-hydrogen ratio.

3. Component analyses for a number of different bituminous materials to illustrate effect on composition of vacuum reduction and air blowing.

4. Data on distribution of sulfur in asphaltic residua components.

SEVERAL years of experience, involving many analyses, have indicated the usefulness of the simple method developed by The Texas Co. to separate asphaltic material into a few groups of components having similar chemical composition or similar ranges of molecular weight.

Solvent-Extraction Methods

Bituminous materials derived from petroleum comprise the most complex and highest-boiling compounds originally present in the crude oil or which have been formed as a result of processing. The only portions present in an asphalt may be expected to be of a chemical nature similar to those found in the lubricating-oil fractions obtained from the parent crude oil except that they are higher in molecular weight. In addition to these oily components there apparently is present a group of materials of still higher molecular weight which vary in consistency from a semisolid to a solid. Although considerable work has been done in recent years[1] not too much is known about the composition of this highly asphaltic material and its physical state as present in the asphalt.

Asphaltenes and resins . . . Usually such high-molecular-weight material is obtained by deasphalting the bituminous material by the use of selective solvents. If normal pentane is used as a deasphalting agent the precipitated material is known as asphaltenes. Normal pentane precipitates about 1.1 times the amount of material obtained when using 86° B. naphtha. The latter is commonly used in asphalt work. However, since it may vary considerably in composition, n-pentane is preferred.

If propane or n-butanol[2] is used as a precipitant additional material known as resins may be considered to be precipitated with the asphaltenes. Many investigators have based their studies on the concept that asphaltenes and resins exist as such in the original mixture either as colloidal dispersions or as solutions. Yet, there is no direct evidence that this is true, and since the amounts of the asphaltenes and resins vary with the precipitating conditions as well as with the source of the asphaltic material, conflicting statements regarding the significance of asphaltenes and resins have appeared in the literature. Although, asphaltene content is frequently included in asphalt specifications, it is doubtful that correlations of the quantity of this component with service behavior can be shown to hold rigorously.

More fractions . . . The difficulties of interpreting service characteristics of asphalts in terms of their composition as defined by the Marcusson method[3] have led numerous investigators to develop refined methods wherein the asphalts are separated into a greater number of fractions. Hoiberg and Garris[4] have proposed such a fractionation wherein asphaltic materials are separated into five components, and Knowles, et al[5] have described a procedure for the separation of asphalts into seven characteristic fractions. While these refined methods of analysis undoubtedly will add to information concerning the composition of asphalts, it would appear that the possible combinations and permutations for more than three groups of components lead to complications in interpretation of the results.

Practical Method

In an attempt to develop a method for analyzing asphalts that would be more simple and of more practical value than those now currently employed, attention was directed to a solvent fractionation into three components. By such a procedure the results could be plotted on a ternary diagram to permit visual comparisons. The components were selected on a rational basis. The higher-molecular-weight materials (asphaltics) were obtained by a deasphalting step using normal butanol as the selective agent. The extract containing the oily fractions was then subjected to an acetone extractive procedure developed by Knowles and coworkers.[6] Acetone is known for its selective extraction of aromatic and naphthenic groups from paraffinic compounds.

By this two-step fractionation described in detail later, it is possible to separate bituminous materials into three components. The "asphaltics" are insoluble in n-butanol, the "paraffinics" are soluble in n-butanol but insoluble in acetone, whereas the "cyclic" fraction is soluble in both solvents. If the refractive indexes of the paraffinic and cyclic fractions are measured, together with the amounts of each component, rather definite information is provided characterizing the particular material under study.

*The Texas Co., Port Neches, Tex.
†University of Florida, Gainesville, Fla.

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Asphalt for Roofing Materials—1

by W. L. Nelson
Technical Editor

"What properties are needed in an asphalt that is to be used for asphalt shingles and roof coatings?"—W.M.W.

Although 90 per cent of all roofing material sold in the United States are asphalt roofing products (U. S. Department of Commerce), the literature on the properties of the asphalts is not extensive. Four general types of asphalts are used: (1) roll-roofing saturants, (2) shingle saturants, (3) coating asphalts, and (4) mopping asphalts.

Roll-roofing saturants are used to saturate the rag or asbestos felt that is used in making roll roofing. They are semisolid materials having softening points of 100°-120° (or 140°) F. Shingle saturants are similar to roll-roofing saturants except that they are harder (140°-170° or 180° F. softening point). The saturating asphalts are usually produced by air-blowing of the residues of asphalt or semiasphaltic crude oils. Coating asphalts are used as a finish coat on roll or shingle roofing and in builtup roofs. They are even harder (210°-240° or 260° F. softening point) than the saturating asphalts, and they are usually air-blown petroleum products but sometimes admixed with Gilsonite or other hard native asphalts or fatty acid pitches. Finally, hot mopping asphalts are used in builtup constructions. These have softening points (165°-200° F.) above the saturating asphalts, but they are heated to 400°-475° F. for application. Builtup roofs are fabricated in place by applying alternate layers of asphalt, saturated felt, and hot mopping asphalt, sometimes topped off by gravel or crushed slag imbedded in the top hot coating of asphalt.

The properties of typical asphalts sold in the United States, as well as A.S.T.M. specification limits are shown in Tables 1 and 2. These were taken mainly from E. H. Berger, "Choice of Asphalt for Asphalt Roofing," Third World Petroleum Congress, Section VII, page 485. In a subsequent issue, the performance properties of roofing asphalts will be discussed and tables of the properties of saturants for shingles and coating asphalts will be presented.

TABLE 1—ASPHALT SATURANTS FOR ROLL ROOFING

	A.S.T.M.	Range sold
Specific gravity at 60° F.	0.99-1.035	0.997-1.033
Softening point (R. & B.)	105-115	104-111
Penetration at:		
32° F., 200 g., 60 sec.	30 up	36-56
77° F., 100 g., 5 sec.	90-150	128-187
Flash point (C.O.C.)	450 up	475-615
Fire point		555-710
Loss, 5 hours at 325° F.	Below 1%	None — 0.3
Loss in penetration after heating	Below 20%	9.6-24
Soluble in carbon tetrachloride	Over 99	99.3-99.9
Viscosity Furol at:		
250° F.	Under 350	
300° F.	Under 100	52-93
350° F.	Under 40	21-38
400° F.		14-19
Foam test, sec. for first clear spot	Under 300	49-560
Compatibility with coating at 130° F. for 72 hours	Under 1.5 mm.	
Oliensis Heterogeneity, test for 24 hours	Negative	Negative

TABLE 2—MOPPING ASPHALTS FOR BUILTUP ROOFING

	A.S.T.M.		Range sold	
	3-in. slope with nailing 1½-in. slope without nailing	6-in. slope with nailing 3-in. slope without nailing	3-in. slope per ft. with nailing	6-in. slope per ft. with nailing
Specific gravity at 60° F.	Over 1.0	Over 1.0	1.002-1.044	1.007-1.014
Softening point (R. & B.)	165°-180° F.	185°-200° F.	172-177	187-196
Penetration at:				
32° F., 200 g., 60 sec.	10 up	10 up	9-22	9-19
77° F., 100 g., 5 sec.	25-40	20-30	17-40	16-32
115° F., 50 g., 5 sec.	Under 100	Under 60	50-75	38-60
Ductility at 77° F.	Over 5 cm.	Over 3 cm.	4-6 cm.	3-5 cm.
Flash point (C.O.C.)	Over 450° F.	Over 450° F.	455°-600° F.	425°-635° F.
Soluble in carbon tetrachloride	Over 99.5%	Over 99.5%	99.3-99.8	99.2-99.7
Behavior on heating 5 hours:				
Loss, per cent	Under 0.5% at 325° F.	Under 0.5% at 325° F.	0.3-4.2 at 500° F.	0.2-3.0 at 500° F.
Coking, per cent of surface			20-28 at 500° F.	Trace — 10% at 500° F.
After heating:				
Softening point			183-208 at 500° F.	197-215 at 500° F.
Penetration at 77° F.	Under 20% at 325° F.	Under 20% at 325° F.	10-26.7 at 500° F.	9.4-33.3 at 500° F.
Soluble in carbon tetrachloride	Over 99.5% at 325° F.	Over 99.5% at 325° F.	99.1-99.8 at 500° F.	98.3-99.7 at 500° F.
Viscosity, Stormer 100 g., 100 rev.:				
Sec. at 350° F.			144-300	220-330
Sec. at 375° F.			78-156	115-168
Sec. at 400° F.			48-84	58-93
Slide test at 160° F., ½-in. cube, 30° slope—Barrett:*				
2 hours, in.			¼—1⅜	⅝—1
4 hours, in.			1⅜—2	⅝—1⅜
6 hours, in.			1¼—2½	⅜—1⅝

*Weiss, J. M., "Methods of Analysis in the Coal-Tar Industry," Ind. Eng. Chem. X, 732, 817 and 1,006 (1918).

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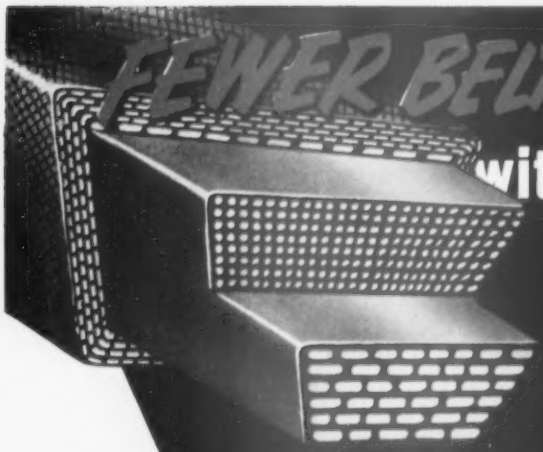

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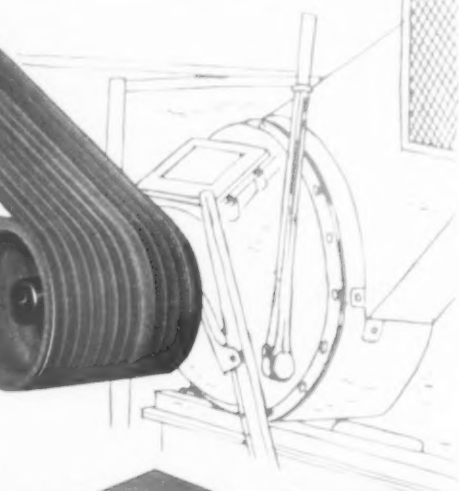

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EQUIPMENT MEN . . . in the News

BS&B Names Siver to Executive Engineering Post

C. A. SIVER

Election of Chester A. Siver as vice president and general manager of engineering, Black, Sivalls & Bryson, Inc., Kansas City, was announced recently by Kenneth W. Lineberry, president.

Siver joined B.S.&B. early in the year as general manager of engineering, assuming company-wide supervision of engineering activities, which includes engineering staffs in Kansas City, Oklahoma City, and Tulsa. Siver was formerly associated with Linde Air Products Co., and was more recently manager of engineering of The Liquid Carbonic Corp., Durable Goods Division, Chicago.

A graduate of the United States Naval Academy, Annapolis, Siver received a master of science degree in mechanical engineering from Massachusetts Institute of Technology. He is a graduate of the advanced management program, Harvard Business School.

Lane-Wells Board Chairman Receives Engineering Award

W. T. WELLS

In recognition of outstanding achievement in engineering, Walter T. Wells, chairman of the board of Lane-Wells Co., received the Dean Anson Marston Award of Iowa State College at Ames, Iowa, on June 12, 1953. This medal is one of the most coveted in the entire engineering profession and is presented to one alumnus each year, at least 30 years after his graduation.

On June 20, 1953, Wells received an honorary degree of master of public service from California State Polytechnic College at San Luis Obispo, Calif. This is in recognition of the many services he has made in behalf of Cal Poly and education in general.

In June 1946 Wells received the Chicago Alumni Association merit award of Iowa State College, given each year to an outstanding alumnus in engineering. On February 21, 1952, West Coast University conferred on Wells an honorary degree of doctor of science for distinguished service in the advancement of engineering education. Wells is a member of the State College Council representing California Polytechnic College and is also a member of the president's advisory council of George Pepperdine College, Los Angeles.

Youngstown Buys Interst In Perrault Fibercast

J. L. MAUTHE

J. L. Mauthe, president, The Youngstown Sheet & Tube Co., has announced acquisition by Youngstown of an interest in Perrault Fibercast Corp., of Tulsa. This concern, which in the future will be known as The Fibercast Corp., manufacturer of glass fiber-reinforced thermosetting plastic pipe. This product, marketed under the trade name Fibercast, has wide application where full corrosion resistance is required. It will be distributed through Continental Supply Co., The Youngstown Steel Products Co., and The Youngstown Steel Products Co. of California. All of Youngstown's sales outlets will handle Perrault Fibercast pipe.

Tatkin Named West Coast Sales Agent for Enardo

Phil B. Drane, president of Enardo Manufacturing Co., Tulsa, recently announced the appointment of Albert I. Tatkin as West Coast sales agent for the entire line of Enardo oil-field specialty products. Tatkin heads Western Industrial Sales at Long Beach, Calif. The company, which is a member of the Manufacturers' Agents National Association, represents many major eastern manufacturers of petroleum and chemical equipment.

Tatkin started his industrial career in 1941 as a junior field engineer for a geophysical company. In 1947 Tatkin joined the sales staff of Vapor Recovery Systems Co., and in February 1953 he formed Western Industrial Sales.

Axelson Promotes Rose, Witzel to New Sales Posts

J. R. Walker, sales manager, petroleum equipment division, of Axelson Manufacturing Co., division of Pressed

C. E. ROSE

D. L. WITZEL

Steel Car Co., Inc., has announced the promotion of Clayton E. Rose to California sales manager, and Dolph L. Witzel to assistant California sales manager.

Rose started with Axelson in 1935 in the company's Taft, Calif., field store. Before his current promotion he served as assistant California sales manager.

Witzel also joined Axelson in 1935 starting as a stock clerk, and has worked as a pump repairman, salesman, and store manager. He was formerly district manager of the Long Beach, Calif., district.

Grove Regulator Opens New District Warehouse

Corpus Christi, Tex., is the site of a new district warehouse recently opened by Grove Regulator Co. J. D. Hicks, district manager, in charge of the new facilities, has announced appointment of C. J. Scott and D. M. Cooper to the staff.

Grove Regulator manufactures Seal-O-Ring gate valves, Flexflo valves and regulators, and other fluid and gas control equipment. The new Corpus Christi warehouse will serve Grove equipment users throughout southeastern Texas and surrounding areas.

Product Development to Represent Pacific Lumber

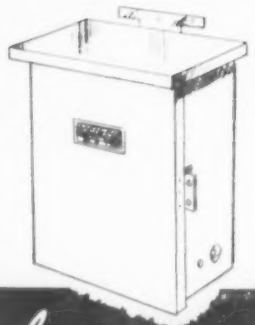
Appointment of Product Development Co., of Houston, as sales representatives for Palco Seal, a circulating-mud loss fiber, and Palcotan, a drilling-mud additive for reducing viscosity and controlling gel strength and water loss, has been announced by The Pa-

NOW... you can get three-phase advantages on single-phase lines

TWENTIETH CENTURY PHASING UNIT

for oilfields and industrial installations...

The Twentieth Century Phasing Unit improves power factor and utilizes all the protective devices of a standard motor controller. It is easy to install and easy to maintain . . . costs less as compared to single phase motors. There is no need to stock both three phase and single phase motors as spares. Now you need handle only three-phase motors. The Twentieth Century Phasing Unit incorporates many protective all-weather devices thus permitting operation at all times.



When it's Electrical

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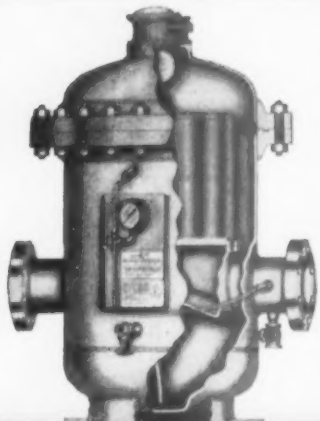

EXCEL-SO 5 MICRON FILTERS for finished PETROLEUM PRODUCTS

Designed to remove dirt (down to 5 microns) from finished petroleum products . . . removal of this microscopic rouge lengthens the life of jet and gasoline aircraft engines, pumps, meters, valves, and fittings. They are compact in size and are built for operating pressures from 0-2500 psi. EXCEL-SO Filters can be built to any code requirement, API-ASME, ASME or state codes for unfired pressure vessels. They also meet requirements of JAN or MIL specifications. Available in capacities from 10-2000 G.P.M. Special "Throwaway" Plastic Filter Bundle available on request. Write for Bulletin FO-52.

WARNER LEWIS COMPANY

BOX 3096 • TULSA, OKLAHOMA

cific Lumber Co., manufacturer of these products. Product Development will maintain representation throughout the United States with the exception of Pacific Coast states, and will distribute the products through companies maintaining field engineering service.

L. R. (Roy) Dawson, general manager of Product Development, was formerly director of research for The Great Lakes Corp. at Houston, and previously for The Milwhite Co. of the same city. Earlier, he was associated for some years with Dow Chemical Co. of Freeport, Tex., and later managed his own manufacturing company. He holds a chemical engineering degree from University of Texas.

Killfoile Made Divisional Manager by OTM Corp.

OTM Corp., Houston, manufacturers of industrial flanges and welding fittings, has appointed Daniel J. Killfoile as eastern division manager with offices in New York City.

Killfoile comes to OTM with 17 years' practical experience in oil and chemical construction materials, having worked both in sales and in the field. He was formerly associated with Chemical Construction Corp., of New York City.

Other OTM branch offices are located in Tulsa, New Orleans, Odessa, Tex., and Houston.

Caterpillar Tractor Co. Creates Engine Division

Creation of the engine division, a new major component of the company, has been announced by L. B. Neumiller, president of Caterpillar Tractor Co. Coincidental with this move was the announcement by G. E. Spain, vice president, of a realignment of sales and advertising activities.

The new division will be managed by H. H. Howard, formerly director of domestic sales. He will have administration of the company's commercial engineering, orders, product engineering, pricing, and scheduling of all engines. In addition, he will be in charge of the sales of engines to manufacturing customers.

Spain announced establishment of the sales promotion department with W. K. Cox, now advertising manager, as manager of the new department. The sales training division, sales development division, and the advertising department are to become the three divisions of this new department.

Named to succeed Howard was W. S. Zeigler, now assistant director of domestic sales, who will manage the domestic sales department

Emsco and D+B Consolidate Sales Offices in Dallas

Consolidation of the general sales offices of Emsco Manufacturing Co. and its D+B Division in Dallas, has been announced by William C. Kinder, vice president, recently appointed general manager, sales.

The change will not only bring the direction of the sale of D+B production equipment and Emsco machinery products under one head, but also under one roof.

Dallas was selected because of its central location to all oil-field activities. Staff and personnel shifts will be made to implement the reorganization of the sales group.

Wilson Associates With Empire Machinery Co.

Announcement is made of the association of Harold A. Wilson with Empire Machinery Co.

For the past 6½ years Wilson had been West Texas district supervisor of production equipment sales for National Supply Co., and was employed by National since May 1941, with the exception of 3 years during World War II while a member of the United States Marine Corps.

S. C. Carter Co. Appoints Two New Distributors

S. C. Carter Co., Inc., Los Angeles, manufacturers of the Carter long-stroke hydraulic pumping unit, has announced the appointment of The Buckeye Supply Co. as distributors for the State of Ohio. Buckeye will handle sales and service of the Carter units from its head office at Zanesville and branch at Wooster, Ohio.

The company has also appointed Wilson Supply Co. as distributor for South Texas. Wilson Supply will handle sales and service of the Carter units from its headquarters at Houston and branches at Alice, Barbers Hill, Bay City, Beaumont, Columbus, Corpus Christi, Liberty, and Victoria, Tex.

Here's a product that—

- Gives positive pressure relief!
- Saves vapor loss!
- Protects against fire!

BS&B COMBINATION VENT VALVE FLAME ARRESTER

MODEL VVFA

MODEL VVF

Has all the features of Model VVFA, except arrester bank. Can be a secondary relief valve with higher setting, or primary relief valve on non-flammable materials.

Patented Cantilever-Type Arrangement of rubber to metal seating makes for high vapor conservation...gives a tight seal in a hurry to cut off oxygen supply and extinguish flame. And this snuffing action is automatic!

Safe, Positive Protection to storage tanks containing flammable material is assured, thanks to exclusive BS&B design. And the high efficiency Vent Valve Flame Arrester has excellent flow characteristics!

Cleaning is Simple, since valve bonnet can be left on when taking out arrester bank. Valve stays in service during time arrester is being cleaned. Remember, with Vent Valve Flame Arresters maintenance time is cut in half, cost is cut even lower. Let us tell you how BS&B Vent Valve Flame Arresters may give you a more efficient, economical operation . . . with greater safety!

This bulletin tells the complete story. Write for it today!

Your Free Copy of Bulletin E-601 will tell you the seventeen outstanding features that make BS&B Vent Valve Flame Arresters your best buy. Or, ask your BS&B man to study your particular requirements. There's no charge, no obligation.

SAFETY BS&B HEADS

See our exhibit at the Eighth National Instrument Exhibit, September 21 to 25, Sherman Hotel, Chicago—Booths 148 to 150

BLACK, SIVALLS & BRYSON, INC.

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...have set their own standards

Many of the largest users of Welding fittings refuse to accept any other fittings than WeldELLS.

They have found that when the name, WeldELL, is stamped into a fitting, that fitting can be accepted without question for any service for which it is designed.

They have found that WeldELLS have features that please both the men who design and the men who erect welded piping . . . features that were pioneered by Taylor Forge . . . features that are combined in no other welding fittings.

They have found the answer to their every need in the greater range of sizes, weights and types of the WeldELL line . . . in the broader scope of materials.

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DIGEST OF NEW EQUIPMENT

IT'S NEW — CHECK IT

TRADE LITERATURE

1 SECURITY, THE NUT YOU CAN'T SHAKE LOOSE. This eight-page brochure profusely illustrates and describes a variety of locknuts in a wide range of sizes and metals. Brochure also describes, with cutaway illustration, Studloc for locking tappet adjusting screws, cylinder-head studs, housing covers, and flange studs in place. Specifications, as well as installation photographs, are included. *Security Locknut Corp.*

2 MINIATURE INDICATOR. Construction, installation, and design features of a remote miniature indicator are described in a new 12-page multicolored bulletin. Pneumatically operated Ratographic instrument has combined advantages of small size and a long drum scale. Photographs show construction of bellows spring assembly, as well as details of other components. Bulletin explains incorporation of various types of warning devices in the instrument. *Fischer & Porter Co.*

3 OIL-INDUSTRY MAINTENANCE WELDING. This new four-page folder discusses various salvage and maintenance applications, item by item, from drill bits to crown block to show precautions and procedures recommended for efficient welding operations in this industry. *Eutectic Welding Alloys Corp.*

4 BULLETIN E-252 describes Models 160 and 210 super chief portable compressors. Literature contains complete specifications and illustrations of two-wheel, four-wheel, and skid units. Various component parts are also described in detail. *Davey Compressor Co.*

5 NEW IDEAL TYPES T-8 AND T-8-S HOISTS are presented in a new 16-page illustrated bulletin. Applications, construction, and mobile mounting methods are covered in the bulletin, as well as performance charts, dimensional diagrams, and specifications. *National Supply Co.*

6 TECHNICAL LITERATURE ON OIL-INDUSTRY COATINGS. Advantages and use of synthetic resin-base coatings are described in a new eight-page illustrated folder. Case histories, test results, and photographs of actual industrial applications of finishes are presented. These resin-base coatings may be applied by brushing, roller-coating, spraying, or dipping. Specific applications described include sucker rods, well-head corrosion, and off-shore drilling operations. *Bakelite Co., Div. of Union Carbide & Carbon Corp.*

7 PIPE-LINE PUMPING, an eight-page, two-color booklet, features complete power packages for all pumping needs. Oil-field engines running on regular diesel fuel, crude oil, and natural gas are pictured in permanent and emergency pumping stations. Horsepower ratings for each engine model for intermittent 1-hour output, rated 12-hour output, and continuous 24-hour output are included. *Caterpillar Tractor Co.*

8 BULLETIN 501 gives dimensions, ratings, full data on Fig. 444 series all-purpose forged steel valves built in sizes ¼ to 2 in. inclusive, globe or angle, screwed or socket welding ends, 600 or 1500 lb. sp. classes, in carbon or chromium molybdenum steel. *Edward Valves, Inc.*

9 HIGH-SPEED STEAM TURBINES for centrifugal compressor

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Corresponding to new equipment items or trade literature abstracts in the Oil and Gas Equipment Digest of The Oil and Gas Journal, Aug. 31, 1953

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and blower drives are the subject of Bulletin 1966-536-BP, which describes manufacturing and engineering features of the turbines, including four types of governing arrangements, hand and automatic nozzle controls, and other controls and accessories. *Worthington Corp.*

10 **MULTIGATE REMOTE SUPERVISORY CONTROL SYSTEM,** designed for use by petroleum refineries, pipe line, and power companies, is described in a new four-page, two-color bulletin. Equipment is designed for operation over wire lines, microwave, or radio lengths, or combinations to provide on-off control, switching or signaling at one or several remote points. *The Hammarlund Manufacturing Co.*

11 **BULLETIN 15C** illustrates and describes complete line of scales, balances, weights, and accessories. Included are trip scales; general laboratory balances; analytical, torsion, spring, specific gravity, and special-purpose balances. *Central Scientific Co.*

12 **BOILER FEED CONTROL.** Bulletin 1013 illustrates and describes new Type 3-L boiler feed control, a three-influence instrument-type for high-duty boilers. It combines the scientific balance, characterized ports and rugged dependability of the Copes control valve with the responsiveness and accuracy of instrumention by Taylor. *Copes-Vulcan Division.*

13 **AS NEAR AS YOUR TELEPHONE,** a convenient pocket-size directory, gives the name, street address, and telephone number of 32 Cooper Alloy stainless steel valve and fitting distributors and their numerous warehouse locations. This handy state directory also covers Canada and Cuba, and gives locations for all Cooper Alloy distributor representatives. *The Cooper Alloy Foundry Co.*

14 **PACKAGE WATER CONDITIONING PLANT,** an eight-page bulletin, graphically describes and illustrates this versatile and self-contained unit, designed to chlorinate, coagulate, clarify, filter, neutralize, dealkalize and soften raw water supplies. Bulletin lists component parts of the complete water conditioner, details the principles of operation, gives ratings, capacities and sizes and illustrates some typical installations. *The Permutit Co.*

15 **WELDMENTS** is a new 16-page bulletin which explains advantages of using steel weldments, and outlines qualifications for weldment manufacture and indicates some of the production facilities available in company's three plants. Technical section presents comparative properties and advantages of steel vs. cast iron, and general data showing weldability of ferrous metals. *Struthers Wells Corp.*

16 **STUD-WELDED FASTENERS** is a revised file of application data and specifications covering methods for securing various types of refinery equipment insulation by use of stud-welded fasteners. Basic types of fasteners covered in the file include headed insulation studs for securing glass fiber to steel; slotted lagging studs through which wires can be threaded to secure block type insulation; split studs for welding through predrilled block material, and rectangular metal lath studs for use in attaching wire mesh. *Nelson Stud Welding Div., Gregory Industries, Inc.*

17 **CUSHIONED FLOWTROL VALVE.** Bulletin W-8 describes valve which can be used to either replace troublesome gate valves requiring frequent manual opening and closing, or in place of diaphragm valves. Flowtrol valves can be used on water, oil, air and many liquids — on pressures ranging from 15 to 400 psi.—available in sizes 2 through 36 in. Design and construction features, along with dimensions and specifications, are fully described. *Golden-Anderson Valve Specialty Co.*

18 **HYDRAULIC FLUID LINE TUBING.** New four-page bulletin includes joint industries conference recommended practice for Standards For Industrial Equipment, analysis and description of cold drawn seamless steel hydraulic tubing that meets these standards, and table of sizes and calculated bursting pressures of steel hydraulic tubing available for shipment from stock. *Tubular Products Div., Joseph T. Ryerson & Son, Inc.*

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DIGEST OF NEW EQUIPMENT

IT'S NEW ✓ CHECK IT

by Dan B. Miller

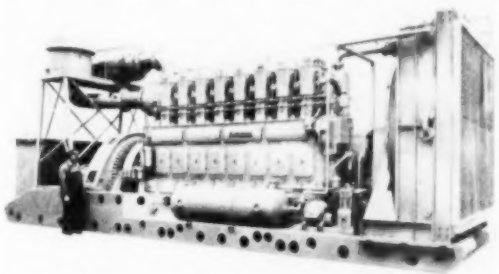
19 844 CU. FT. DISPLACEMENT, VALVE-IN-HEAD, V-8 INDUSTRIAL ENGINE. Designed to provide continuous heavy-duty service over a wide range of speeds up to 2,000 r.p.m., the Le Roi H844 is a sister unit to the well-known H540 used in the oil fields as a power unit in electrical-generating sets and similar applications. The unit features removable wet-type cylinder sleeves, cam-ground aluminum pistons, a gear-driven water pump, an extra-heavy counterbalanced crankshaft, full-pressure lubrication, and water-cooled manifolds. The H844 will be used in slim-hole drilling rigs, workover rigs, well-servicing equipment, oil-well pumping, and pipe-line applications. The H844 develops 210 hp. at 2,000 r.p.m. and can be equipped to burn natural gas, butane-propane, or gasoline. *Le Roi Co.*

IT'S NEW ✓ CHECK IT

20 A SPRAY-TYPE FOAM MAKER, designed to blanket flames with air foam over a wide area all at one time, is for overhead protection of medium-sized petroleum and chemicals hazards. The foam maker, generating the fire-fighting foam right at the hazard, is equipped with a cone-shaped spray head which discharges an even pattern. The device is for use in fixed systems, singly, or in multiples, indoors or out. The foam spray unit should be located at least 4 ft. above the hazard to obtain full discharge coverage. Coverage ranges from 10 to 20 ft. in diameter, depending on the operating pressure, from 30 to 100 psi. The new equipment is for protection of oil-filled transformers, pump rooms, loading racks, drip pans, drain boards, sumps, process tanks, drilling rigs, and other hazards in petroleum storage, loading, and production areas. *Pyrene Manufacturing Co.*

IT'S NEW ✓ CHECK IT

21 NEW PORTABLE POWER PLANT. A new 1,000-kw. portable diesel generator set is wholly self-contained on a skid mount. Fuel tanks, radiator, control panel, and all necessary gear are mounted on a common skid.



The unit can be ocean-shipped or trailer-transported, ready for generation of electrical current on arrival. The largest of these skidded power plants is approximately 35 ft. in over-all length. Smaller units in the 100 to 500-kw. range are approximately 10 ft. over-all length. Weight range is from 5½ to 22½ tons. *Enterprise Engine & Machinery Co.*

IT'S NEW ✓ CHECK IT

22 SERIES T-2 TRIPORT VALVES, AND GAGE COCKS. Resilient O-ring seals are utilized in the seat assembly to provide bubbletight shutoff for flow in either direction, as well as on the stem, to replace conventional stuffing-box packing. Minimum wear is claimed to result from the fact that the stem slides open and closed without turning. It is actuated by the handwheel, threaded to the outside of the integral bonnet. This provides an external nonfouling maximum threaded bearing surface for smoother operation. A safety stop prevents stem from being forced out by excess pressures. A safety shear ring makes it impossible to back stem out through excess turning on handwheel. Wiping action of the Seal-O-Ring re-

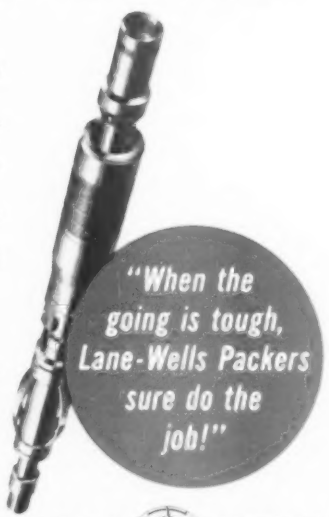
KEEP INFORMED ✓SAVE TIME ✓TEAR OUT CARD ✓CHECK IT ✓MAIL IT

This Digest of New Equipment offers you a quick resume of important features of new or improved products and trade literature and the opportunity to obtain complete information on each subject by use of the convenient "CHECK IT - MAIL IT" service card.

Everywhere I went, they were using Lane-Wells Packers!"

"Getting out in foreign parts sure does give you the real low-down on lots of things. When there isn't a supply store right around the corner, and you can't get parts or replacements just overnight, believe you me, the boys are mighty particular about equipment. And they're using Lane-Wells Packers because these packers stand the gaff and do their job right.

"One of the men put it this way: 'Out here, we can't afford mistakes. So we use the equipment that's *proved* it will do the job—like Lane-Wells Packers. We can depend on them.'"



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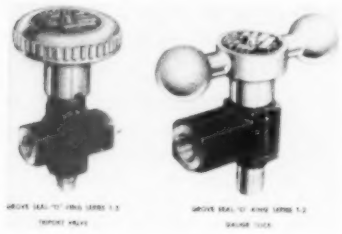
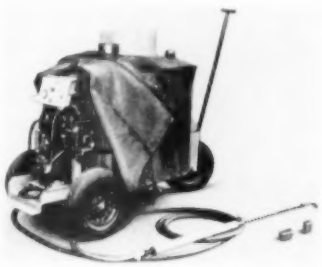
AP-607

tainer and the stem O-ring keeps parts free from damage by foreign matter. This assures a tight seal and maintains exceptionally free valve action. Shutoff is accomplished by the lower rim of the stem which compresses the flexible O-ring seal between the seat, body, and stem. Secondary metal to metal contact is made between the stem and the seat. Both half-inch and quarter-inch valves are available for 3,000, 5,000, and 10,000 psi. Half-inch gage cocks are furnished for 10,000 psi. in globe or angle design. *Grove Regulator Co.*



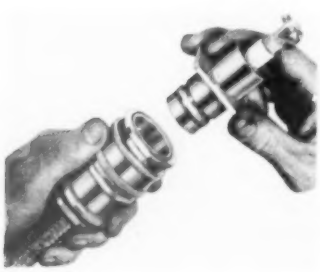
IT'S NEW CHECK IT

23 **NEW "JO" HYPRESSURE JENNY** steam cleaner features maximum utility through easy movement on its rubber-tired wheels, and extra-heavy-duty welded steel chassis. Industry will find this new unit particularly useful, because of its ability to roll over rough ground. Its nozzle control system saves fuel, chemicals, water, and time by permitting operator to start and stop unit at cleaning job, 100 ft. or more from the Jenny. Three steps are necessary to start or stop the unit; and from a cold start, a full-powered blast is delivered at the cleaning gun within 90 seconds. High controlled pressure, the right amount of water, and a wide choice of concentration of cleaning solutions at the nozzle make the unit more effective than ordinary cleaning methods. Its vapor spray output is 90 gal. per hour but the unit is also available with 120 gal. per hour output in series 1200. A zippered canvas machinery cover protects the unit against weather. *Homestead Valve Manufacturing Co.*



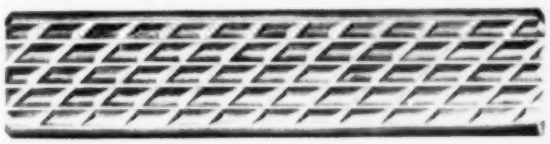
IT'S NEW CHECK IT

24 **QUICK DISCONNECT COUPLING** is for coaxial-cable applications. The highlights of these multi-purpose units are: the small size produced with the quick disconnect feature; injection molded and machined Teflon insulators; and beryllium copper receptacle connections that handle, for 1 minute, potentials of 7,000 volts RMS at 60 cycles. All metal parts are silver plated to .0002 minimum of maximum density. *Hallett Manufacturing Co.*



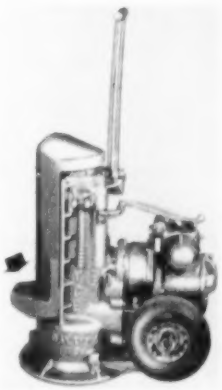
IT'S NEW CHECK IT

25 **STAGGER TOOTH,** a reversible tong die, wears 1½ to 2 times as long under actual field conditions. It is made of highest-quality carburized steel and is designed and processed in such a way as to reduce flaking to the minimum. The advanced stagger-tooth design eliminates longitudinal scoring because teeth are offset and never get into a rut. *Woolley Tool Service.*



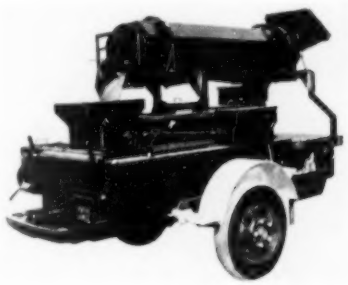
IT'S NEW CHECK IT

26 **NEW TOE-LIFT, AIR-MOTOR OPERATED JACK** will pick up a 75-ton load as low as 9 in. from the floor and lift it as much as 13¾ in. The Toe-Lift can be quickly removed and the jack will lift 100 tons on top of its ram. The jack is the ball-bearing geared-screw type, powered by a 5-hp., multi-vane Ingersoll-Rand, heavy-duty rotary air motor. It features an automatic shutoff at both upper and lower limits of the ram, easy portability with long trundling handle and large roller-bearing semipneumatic-tired wheels, and a massive base for great stability. *Joyce Cridland Co.*



IT'S NEW CHECK IT

27 **NEW PORTABLE HOT ASPHALT PLANT** features greater capacity and less manual labor. The Patchmobile PM 215 features a rotary dryer, asphalt tank, pug mill, power asphalt pump with spray attachment, volumetric asphalt-measuring device, and asphalt tool-heating compartment, all in one packaged unit. It requires no other piece of equipment on the job, except a truck for towing. No manual handling of aggregate and asphalt is necessary during the entire process of mixing the material. Material is fed from the dump truck into the charging chute of the rotary dryer. As the dryer rotates, the material is conveyed by means of flights through a blast of flame from the dryer burner to the discharge chute and



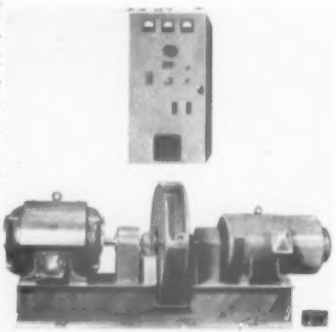
into a batching hopper located directly above the pug mill. As the hot, dry aggregate is released into the pug mill, the correct proportion of hot asphalt from a volumetric measuring reservoir is discharged into the pug mill through a spray bar. As the asphalt reservoir is emptied it is immediately refilled by a power-driven asphalt spray pump. The aggregate and asphalt is mixed and conveyed through the pug mill to the discharge gate where the hot, mixed material is ready to be used. *Wylie Manufacturing Co.*

IT'S NEW CHECK IT

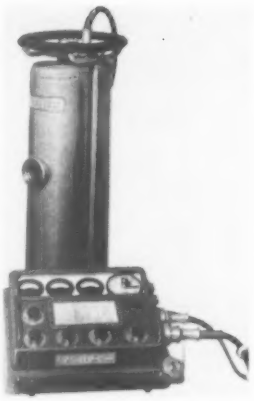
28 OPTIONAL HEAVY-DUTY TRENCH HOE BOOM is for the Gar Wood 75 series excavators. Designed for extra rugged excavation, crosscountry pipeline work, and other extreme operations, the new boom weighs 8,500 lb. As is the standard trench hoe boom, it is easily removed for conversion to shovel, crane, drag line, clam shell, pile driver, and the exclusive foundation borer attachments on the 75A, the heavy-duty 75B, and the 75BT truck crane. *Gar Wood Industries.*

IT'S NEW CHECK IT

29 NEW FLYWHEEL MOTOR-GENERATOR SET is designed for microwave system power supply. These flywheel generator sets and associated emergency transfer control insure continuity of power supply for microwave equipment used for protective relaying, supervisory control, and communication on utility, pipe line, and similar long-distance systems. During normal operating conditions, the set operates off of the commercial power system. When there is a power-system disturbance, or outage, the energy stored in the flywheel drives the generator to supply power, with a frequency tolerance down to 50 cycles, for a 7-second interval. The 7-second interval allows sufficient time for the automatic starting of an emergency standby generator set and automatic switching of microwave equipment from the flywheel motor-generator set power source to the emergency power source. Automatic transfer control has a frequency relay sensitive to a 1½-2 cycle decline which initiates starting of the standby power supply. When standby power voltage and frequency are normal, a mechanically interlocked throwover switch connects the microwave equipment to the standby set. The microwave equipment is automatically transferred back the the motor-generator set when commercial power is restored. *Electric Machinery Manufacturing Co.*



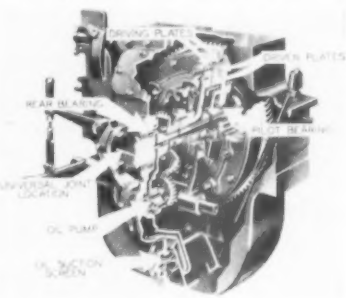
IT'S NEW CHECK IT



30 NEW 250 KVP INDUSTRY X-RAY UNIT features complete portability. Its over-all weight, including the control unit, is less than 350 lb. and the entire unit fits easily into the trunk compartment of a late-model automobile. The unit's small size and light weight are the result of eliminating all high-tension cables, cooling connections, separate transformers, and cooling pumps. The X-ray tube and other high-tension parts are combined in a single all-welded steel tank. This unit will penetrate 4 in. of steel. The focal spot is 4 mm., and at a focus-film distance of 24-in. a 17-in. film is covered. Supply voltages are 110-220-440-volt (50-60 cycles). Due to its radical type of construction, it requires little or no service. *Holger Andreasen, Inc.*

IT'S NEW CHECK IT

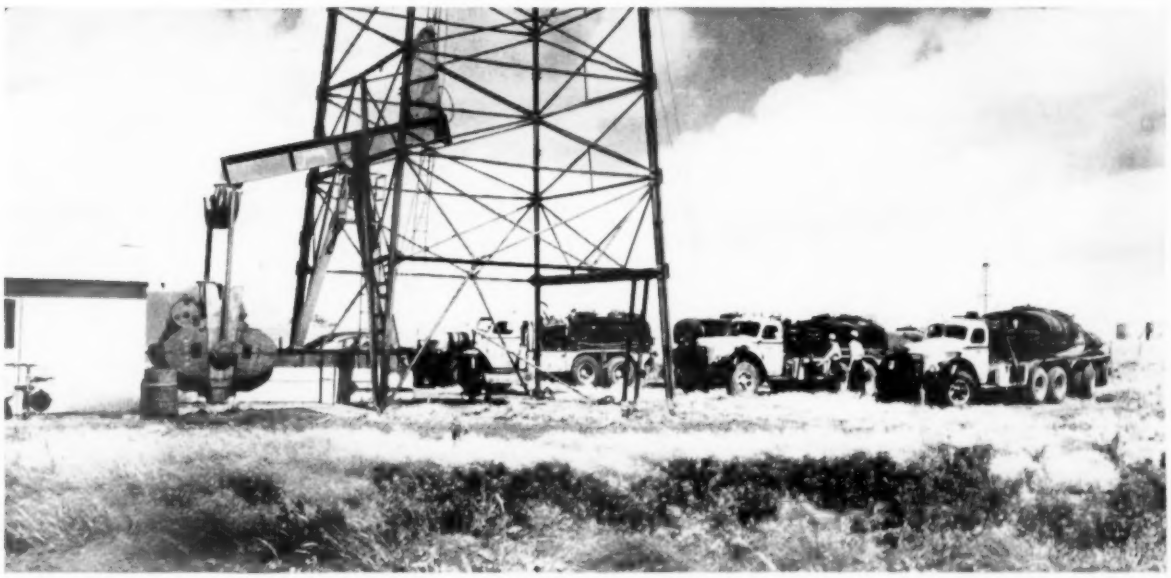
31 OIL-TYPE FLYWHEEL CLUTCH has been introduced by Caterpillar on three of its track-type machines. It is now standard equipment on the Cat D8 and D6 tractors and the No. 6 shovel. It will operate two to four times longer than an equivalent dry clutch before major adjustment or overhaul is necessary. It is intended that under ordinary operating conditions the overhaul period of this clutch will coincide with the normal overhaul of the engine. Where the longer wear of this unit is particularly apparent is in the friction disks. When the clutch is being engaged, the oil adsorbs the entire load up until the last few revolutions before full engagement at which time the friction faces finally come into direct contact. In the closed clutch housing the pump lifts the oil from the reservoir at the bottom of the housing and forces it through and around the clutch shaft in a continuous process. The oil is discharged around the inside diameter of the friction disks. It flows through the grooves and slots in the friction faces and pressure plates even when the clutch is engaged. The oil, ejected from the outside of the flywheel through radial slots, also provides constant lubrication for the cams, bearings, and internal linkage. *Caterpillar Tractor Co.*



IT'S NEW CHECK IT

PRODUCTION INCREASED FROM 60 TO 450 BOPD WITH XM ACID

DOWELL XM Acid treatment boosted production after ordinary acid failed to improve flow



This new oil well had been completed in a dolomitic limestone formation. Ordinary acid had failed to improve production from this and neighboring wells. A trace of emulsion and incomplete return of the spent acid suggested that effective permeability had been reduced by swollen silicates plugging the pore spaces.

The operator decided to employ a Dowell treatment using XM Acid to control silicate swelling and increase production. As a result, production went from 60 to 450 BOPD and the XM Acid treatment resulted in a quick kick-off and clean-up for the operator.

Other Dowell addition agents are designed to remove mud from producing formations; to speed reaction rate; to increase penetrating ability; to increase wetting ability and prevent emulsions; to remove "gyp"; to trace fluid movement; to increase acid weight.

For more information on Dowell addition agents and the many oilfield services and products offered by Dowell, call the nearest office. Or write directly to Tulsa, Dept. H-11.

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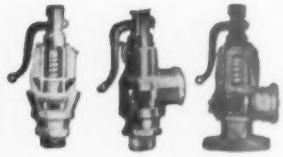

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Among the Drilling Contractors

Midland Operators Form Contract Drilling Firm

John R. Parker, president of Basin Petroleum, Inc., and James G. White, formerly owner of White Drilling Co., both of Midland, Tex., have formed a partnership to engage in contract drilling. The new partnership will operate as Parker-White Drilling Co. with offices in the Central Building, Midland. Three rotary rigs with depth ratings up to 10,000 ft. are being operated. W. A. Birt is drilling superintendent.

Gene Reid Drilling, Inc., has a rig working for Trico Oil & Gas Co. on an extension test, 1 Howard, in the Moffett gas area, in Madera County, California.

Cook Drilling Co. is drilling a projected 8,500-ft. wildcat test for W. O. Woodward, trustee, at 2 Long Bell, in 35-5s-10w, a mile west of the Longville field, 4 miles southeast of Juanita, in Beauregard Parish, Coastal Louisiana.

R. P. Phillips Well Service Co., Lafayette, La., is starting another well, its second, for Monterey Exploration Co. on the north side of the Bayou Bouillion dome, in St. Martin Parish, southern Louisiana. The operator's first test is being completed as a pumping producer in sand at 3,282-88 ft. The second test is projected to 4,000 ft.

Rice Drilling Co. has contracts for two wildcat tests to be drilled for George S. Hammonds, Dallas operator, in western Jackson County, Texas Gulf Coast. Locations are about 9,000 ft. apart, about 10 miles west of Edna. The first is 1 Robinson, in the Martha Isaacs Survey. The other will be 2 Robinson, in the J. J. Linn Survey. Each is projected to approximately 4,700 ft.

John L. Howell is starting a 7,100-ft. test for the account of H. H. Howell of San Antonio at a wildcat location 5¼ miles south of Runge, in Karnes County, Texas Gulf Coast. Location is on the operator's Schorre lease, in the Victor Blanco Survey.

Newton Drilling Co. is the contractor on a 5,000-ft. wildcat test W. W. Holmes of Coalinga, Calif., is starting 1¼ miles south of the Elk Hills Naval Petroleum Reserve. The test, 53-22 WP, in 22-31-24, is near the Taft-Bakersfield highway.

Delta Gulf Drilling Co., Tyler, Tex., has a new contracted operation under way in Evangeline Parish, Coastal Louisiana. It is a wildcat, 1 Eunice

DEEP DRILLERS . . . Day-tour crew on Ohio Oil Co.'s company-owned rig now drilling on the world's deepest test, located in the Paloma field near Bakersfield, Calif. The test passed the previous drilling-depth record of 20,521 ft., set by Superior Oil Co. in Wyoming, August 20 with hole expected to be carried to 21,000 ft. Shown, left to right, are: W. T. White, driller; Roy Baxter, cathead man; Otis Robison and S. R. Norton, floormen; and C. A. Craig, derrickman.

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Canal, located 2 miles southwest of the one-well Duralde field, opened in 1949, in the southwestern corner of the parish. Operators are Paul F. Barnhart and J. Ray McDermott & Co., of Houston. Hole is projected to 8,350 ft.

Well Drillers, Inc., is moving a rig to a wildcat location in the San Salvador area, 1½ miles southeast of Fayesville, Hidalgo County, in the Rio Grande Valley of South Texas, for an 8,500-ft. test it has contracted to drill for Western Natural Gas Co. Location is on the operator's Roberts lease.

Thomas P. Pike Drilling Co., Los Angeles, has a new wildcat operation under way 2 miles southwest of the San Joaquin field in Fresno County, California. The test, 1 Clover, in 12-16s-16e, is being drilled for Ladenburg, Thalman & Co. of New York, a firm which has recently entered the Pacific Coast state.

Jet Drilling Co., Denver, has contracted with McElroy Ranch, also of Denver, for a 10,000-ft. Dakota test about 6 miles southwest of Littleton, Jefferson County, Colorado. This will be the deepest test yet drilled in the general Denver-Julesburg basin area south of Denver.

Rhodes Drilling Co. is starting a 4,500-ft. wildcat test 2½ miles northwest of Dinero, in Live Oak County, South Texas, on a contract with Rhodes & Hicks and associates. Location is for 1 McGuffin, in the J. Poitevent Survey 277. It is about 2 miles east of the abandoned Whittington field.

Brown Drilling Co., Los Angeles, is moving a rig to a rank wildcat location in the Alton area, Humboldt County, California, where it will drill for B-N Development Corp. at 1 Bering, in 16-2n-1w.

ACTIVE ROTARY RIGS*

Area—	Week ended 8-24-53	Change week ended 8-17-53	Change week ended 8-25-52
Gulf Coast	581	+ 5	+103
N. & W. Tex.-N. M.	782	− 8	+ 48
Ark.-N. La.-E. Tex.	146	0	+ 19
Oklahoma	363	− 6	+ 74
Kansas-S. Nebraska	158	+ 2	+ 12
Illinois-Eastern	143	−10	+ 2
Rocky Mountains	258	−13	+ 20
Pacific Coast	167	+ 8	+ 7
Total U. S.	2,598	−22	+285
Western Canada	173	− 5	+ 16
Total	2,771	−27	+301

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States, Gulf Coast, and Arkansas-North Louisiana-East Texas are shown on pages 179 and 180.

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PIPE LINES

Three Crossings Set

Crude, products lines to cross North Dakota rivers

TIOGA, N. D.—Three river crossings on two pipe-line construction projects will be made in North Dakota during September.

Two of the crossings will be made by Service Pipe Line Co. in connection with its 154-mile crude line under construction from a point near here to Mandan, N. D. The line, which will cross the Missouri and Little Missouri rivers, will serve a Standard Oil Co. (Ind.) 30,000-bbl. refinery being built at Mandan. A 205-mile products line being laid by Standard from the new refinery site to Moorehead, Minn., will cross the Missouri east of Mandan this week.

Crude-line crossing . . . Service has completed its 12-in. line from Tioga and Beaver Lodge fields to the banks of the Missouri and Little Missouri. When it pulls the line across the Missouri 18 miles south of here, only a small portion of the heavy river pipe will lie in the Missouri's channel. Over 2 miles of the pipe will be placed in the bed of the proposed Garrison reservoir. Eventually this pipe will be under 80 ft. of water. The giant lake will be formed by water backing up from the Missouri behind one of the world's largest earthen dams being built at Garrison, N. D.

The Little Missouri crossing in Dunn County, which will extend 0.7 mile, will be 16-in. From this point on to Mandon, the remaining 93 miles of the line will be 16-in. Final completion of the entire project is set for early December *(The Oil and Gas Journal, July 20, page 157).*

Products line . . . Standard's 10¾-in. products line across the Missouri near Mandan will also reach its final destination in December. This line will connect with an existing products system in Moorehead.

Both the crude and products lines will be ready for operation nearly 10 months before the new refinery will be completed. During this time Service plans to use part of the crude line as an extension to its gathering system in this area while the gathering system is being revised. The products line will receive products from Moorehead during this 10-month period until the Mandan refinery opens, at which time the flow will be reversed.

Pasotex Plans 150-Mile West Texas Crude Line

EL PASO.—Pasotex Pipe Line Co. has renewed plans to construct a 150-mile, 10-in. crude line to transport sweet crude from Scurry County, Texas, producing areas to the 28,000-bbl. refinery here operated by Standard Oil Co. of Texas.

The proposed line will run westward from Synder, Tex., to the company's existing 8-in. main-line system in Wink-

Boring Under Roads

A new type of boring machine for laying pipe under blacktop roads is being used by a construction crew from Bill Murry & Co., Beaumont, Tex., developers of the apparatus. With the heavy road casing in the background ready to be moved into position, the machine loosens the soil in the bore with a series of water jets. Then a tractor pulls a swab through the bore on a chain leaving a clean hole for the casing. (International Harvester Co. Photo).

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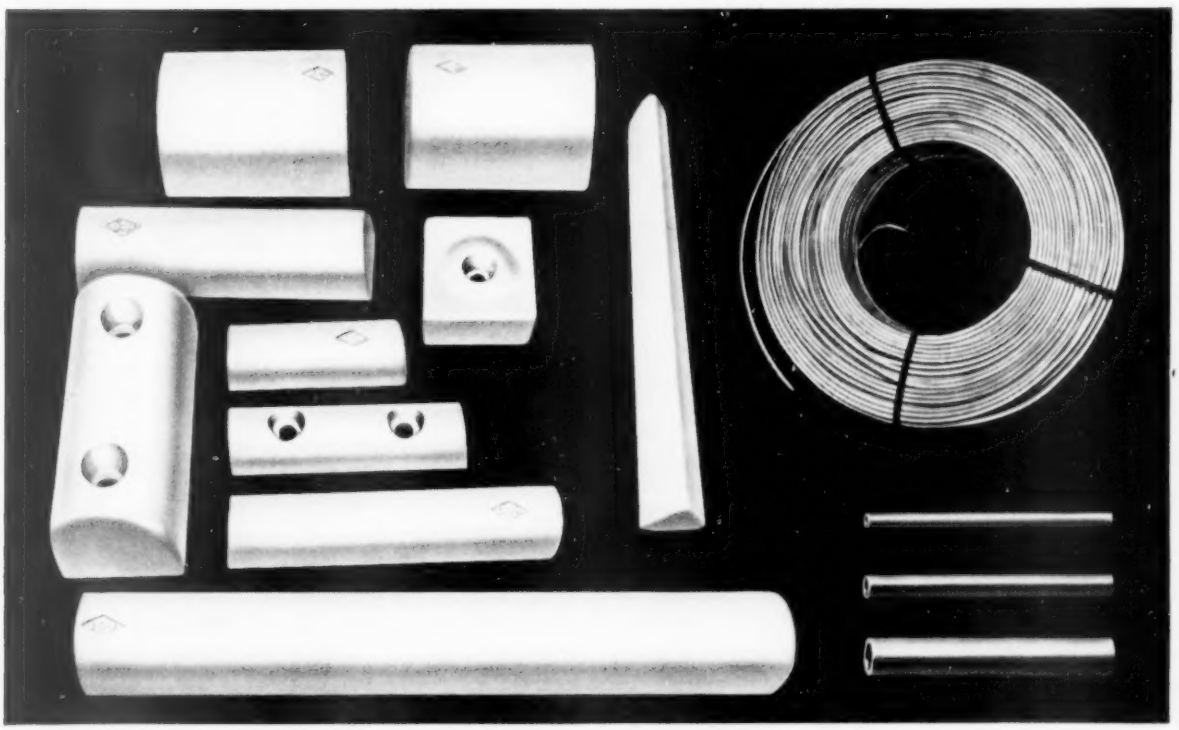

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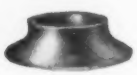

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ler County, Texas. This latter line, which was completed early this year, runs southwest 200 miles to Standard's refinery here. Both companies are affiliates of Standard Oil Co. of California.

The sweet crude will come from Standard's production in Scurry County. A portion of this crude now is shipped through a line to Col-Tex Refining Co.'s 10,000-bbl. refinery at Colorado City, Tex.

Texas Gas Completes Final Segment of 408-Mile Line

OWENSBORO, Ky.—Texas Gas Transmission Corp. has completed and placed in operation the last 45 miles of a 408-mile, 26-in. loop line from Bastrop, La., to a point near here.

The first segment was composed of two sections at Jeffersontown and Slaughters, Ky. H. C. Price Co., Bartlesville, Okla., completed 363 miles of the project August 1 *(The Oil and Gas Journal, August 10, page 153).*

The new loop lines give Texas Gas a total of 3,236 miles of natural-gas lines with an estimated capacity of 1 billion cubic feet daily.

The new segment will make it possible for the Texas Gas system to deliver more gas at its eastern terminus. Presently, the company serves utility and industrial customers in Kentucky, Tennessee, Indiana, Illinois, Mississippi, Arkansas, and Louisiana.

Quarterly Oil Pipe-Line Revenues Up 16 Per Cent

WASHINGTON.—Second - quarter transportation revenue of the nation's 57 largest oil pipe line companies was 16 per cent above the same period last year, according to statistics compiled by the Interstate Commerce Commission.

Both traffic and revenue increased sharply over last year, the former by more than 102,000,000 bbl. and the latter by close to $19,000,000.

The commission reported that the 57 companies transported a total of 874,650,895 bbl. of oil and products during the quarter against 742,265,764 bbl. in 1952, and had transportation revenue of $134,306,358 against $115,785,834.

Fourteen of the 57 companies, however, reported that they handled less volume this year than last, and 13 disclosed they had a drop in transportation revenue.

The heaviest oil traffic was reported by Humble Pipe Line Co., 67,309,941 bbl. in the second quarter 1953 against 70,411,386 bbl. in the same 1952 pe-

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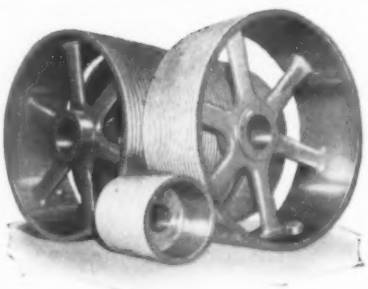

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riod: Gulf Refining Co., 62,386,577 bbl. against 44,404,363 bbl.; Texas Pipe Line Co., 50,183,120 bbl. against 44,937,994; Interstate Oil Pipe Line Co., 47,114,725 bbl. against 44,548,932 bbl.; Service Pipe Line Co., 45,534,597 bbl. against 38,011,529 bbl.; Magnolia Pipe Line Co., 43,549,847 bbl. against 34,782,351 bbl., and Sinclair Pipe Line Co., 42,766,756 bbl. against 37,193,623 bbl.

The largest transportation revenues were reported by the Service Pipe Line Co., $13,819,034 against $11,426,495; Sinclair Pipe Line Co., $9,736,761 against $8,021,571; Humble Pipe Line Co., $9,652,725 against $10,001,383; Great Lakes Pipe Line Co., $8,702,207 against $7,750,379; Magnolia Pipe Line Co., $8,165,878 against $6,352,432, and Texas Pipe Line Co., $7,437,624 against $6,989,886.

Ohio Fuel's Transmission System Being Improved

COLUMBUS.—Ohio Fuel Gas Co. is laying four pipe lines and remodeling a compressor station to improve natural-gas service in southeastern and western Ohio.

The company is replacing a 6-mile, 18-in. transmission line between Mount Sterling and Sugar Grove which will increase deliveries to several southeastern towns and strengthen Ohio Fuel's underground-storage program. In this connection, the Mount Sterling compressor station is being converted into a "two-way" operation for making deliveries to western Ohio and receiving gas for underground storage. Also, a 1½-mile portion of the main line is being replaced between Sugar Grove and Ravenswood, W. Va.

Another project in the southeastern sector of the state involves laying 3½ miles of 12-in. pipe near Chillicothe for direct feeding into that area from main lines.

To the northwest near Toledo another pipe replacement job is being performed with a new 6½-mile 16-in. feeder line supplanting a 10-in. line.

FPC Approves Gas Line

WASHINGTON.—The Federal Power Commission has authorized Southern Counties Gas Co., Los Angeles, to lay 14 miles of 22 and 24-in. pipe to meet rising natural-gas demand in Orange County, California.

The proposed line will run from a point on the company's existing 30-in. Blythe-Santa Fe transmission line near Brea to Santa Ana, Calif. The new facilities will cost about $879,962.

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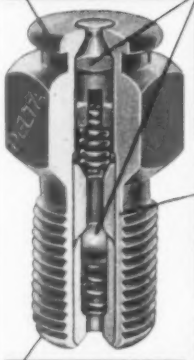
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NATURAL GAS

A.P.I. Offers Instruction In Field Handling of Gas

NEW YORK. — A new vocational training course developed by the University of Texas covering field handling of natural gas is being offered by the American Petroleum Institute's Division of Production.

Using instructors employed and trained by the state departments of vocational training, the course is composed of 10 periods running 3 hours each. The course is designed to train company employes in the gathering, treatment, and control of natural gas on a producing lease, but it can be applied to some phases of natural-gasoline plant operations.

William H. Strang, director of the production division, said the course equipment is mobile and can be set up in "any locality in which the minimum enrollment of eight employes can be obtained." The maximum enrollment is 25 per class.

Strang added that the "class instructions consist of laboratory work and discussion with a minimum of lecturing."

Presently, the A.P.I. is developing four new courses which are expected to be made available to the industry in 1954. These cover field measurement of natural gas, care and use of wire rope, care and use of sucker rods, and care and handling of sucker rod pumps.

Gas Measurement Institute Opens in Kansas October 5

LIBERAL, Kans. — About 150 to 200 persons are expected to attend the Gas Measurement Institute here October 5 and 6.

Arrangements for the 2-day meeting were made by a group of industry leaders and the University of Kansas Extension Center at Garden City, Kans. The institute is intended to present practical information covering the measurement and regulation of natural gas through orifice and displacement meters. Discussions will be designed to help supervisory men who are experienced in this field of work.

The first day will consist of a talk on displacement meters by A. F. Benson, American Meter Co., followed by a discussion on orifice meters by L. K. Spink, Foxboro Co. The second day's program calls for J. L. Cottrell, Rockwell Manufacturing Co., to discuss measurement calculations, and in the afternoon a panel discussion on "Deliverability Methods of Testing Wells" will be held.

Frank T. Stockton, director of special projects for the University of Kansas Extension, Lawrence, will serve as moderator.

NATURAL GASOLINE

Program Shaping Up

C.N.G.A. schedules host of speakers for meeting

LOS ANGELES.—Tentative program for the California Natural Gasoline Association's twenty-eighth annual fall meeting at the Ambassador Hotel here October 8 and 9 has been announced by D. R. Arnold, general chairman of the association.

During the first day of the meet, four forums will be conducted simultaneously.

. . . **Gas gathering** will be the heading for the first forum under the supervision of S. A. Bradfield, Southern California Gas Co., and J. A. Serey, Southwest Exploration Co. A symposium on gas dehydration will be conducted by M. K. Senatoroff of Pacific Lighting Gas Supply Co., and will include an address on "Operation of Dehydration Plant," J. A. Gordan, Union Oil Co.; "Special Problems of Gas Dehydration," J. J. Hull, California Research Corp.; "Low and High-Temperature Effects on Dehydration," Arnold L. Johnson, Shell Oil Co. Also, a talk on "Ultra-Sonic Inspection for Internal Corrosion in Pipe Lines and Pressure Vessels," will be given by D. C. Erdman, Electro-Circuits, Inc., followed by a discussion of "Design, Testing, and Performance of Scrubbers," R. C. Baird, Fluor Corp., Ltd. In the afternoon D. E. McFaddin, Union Oil Co. of California, will speak on "Gasoline Extraction by Refrigeration," and A. H. Tompkins, Jr., Superior Tank & Construction Co., will discuss "Design of Vapor Recovery Facilities." The forum will close with a discussion of "Construction of Vapor Recovery Facilities" by two other Superior Tank & Construction Co. representatives, G. C. Brown and Steve Jeffers.

. . . **Compressors and engines** will be the main topic for the second forum, which will be headed by R. C. Lumus, Pacific Lighting Gas Supply Co., and R. E. Williamson, Cooper-Bessemer Corp. A symposium will feature talks on "Boiling Point Cooling Systems," by Gordon Jackson, Drayer-Hansen Co.; "Heat Recovery," Lloyd Harbert, Engineering Controls, Inc.; "Cylinder-Wall Temperatures," O. B. Freeman and Richard Bland, Tide Water Associated Oil Co.; and "L. O. Coolers, Sizing and Selection," Monty Stone, Long Beach Oil Development Co. Other speakers will include Ned Moerke, Fluor Corp., Ltd., who will talk on "Corrosion and Prevention of Compressor and Engine Piping Vibration," and El Paso Natural Gas Co. will present a discussion on "Gas Turbine Centrifugals."

. . . **Laboratory techniques,** dealing mainly with development and research, will be the third forum under the supervision of Gail D. Carbiener, Standard Oil Co. of California, and J. H. Watson, Union Oil. The morning session will include a talk by J. Wilson, Union Oil, on "New Developments and Techniques on Fractional Analysis," and a discussion of "The Economics of Testing Procedures." In the afternoon a symposium on corrosion mitigation in gas condensate wells and production facilities. This will include presentation of "Basic Causes of Corrosion," T. A. Burkness, General Petroleum Corp.; "Report on C.N.G.A. Corrosion Committee Activities," C. J. Smith, Western Gulf Oil Co.; "Laboratory Techniques in the Testing for Corrosion," John Armstrong, California Standard; and "Report on N.G.A.A. Corrosion Committee Studies."

. . . **Plants and processing** will be the topic for the remaining forum with J. P. Magee, Ohio Oil Co., and Harvey Menard, Signal Oil & Gas Co., moderators. An address on "Design and Evaluation of Absorbers," Knight Raymond, California Research Corp., will be followed by a talk on "The Role of Natural Gas in the Synthetic Ammonia Industry," Frank Kuenzly, Shell Chemical Corp. During the afternoon meeting Glen Gallagher, Fluor Corp., Ltd., will discuss "Trends in Modern Instrumentation."

The morning of the convention's second day will be spent touring Union Oil's refinery here. The afternoon session will open with E. E. Pyles, vice president of Monterey Oil Co., presenting a discussion on "The Future of California Submerged Lands." Also, Harold P. Huls, California public utilities commissioner, will speak on "The Relationship of Public Utility Regulation to the Natural Gas Industry," and Dr. Harrison Brown, California Institute of Technology, will discuss "The Future Energy Sources of the World."

Final speaker of the 2-day meet will be M. E. Spaght, executive vice president of Shell Oil Co., New York.

Glen Cove Plant to Go On Stream This Week

SAN ANTONIO.—The Glen Cove gasoline plant in Coleman County, Texas, is expected to be completed and placed in operation this week.

The plant, which will have a capacity of 5,000,000 cu. ft. of gas daily, will produce about 10,000 gal. of butane and propane mixture, and 10,000 gal. of natural gasoline per day. The reesidue gas will be sold to Lone Star Gas Co. *(The Oil and Gas Journal, June 29, page 139).*

Luling Oil & Gas Co., W. C. Wolf, and N. H. Wheless will operate the facilities, which are designed to conserve gas being flared in Glen Cove field.

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REFINING

American Bitumuls to Build $4,000,000 Asphalt Plant

CINCINNATI.—American Bitumuls & Asphalt Co. of San Francisco, a Standard Oil Co. of California subsidiary, will construct a $4,000,000 asphalt refinery 12 miles west of here on a 100-acre tract located at Miama Ford on the Ohio River.

The new refinery will service and supplement existing company facilities at Howell, Mich., Columbus, and Louisville. It will process high-grade asphaltic crude which will be brought from Venezuela to New Orlenas by tanker and up the Mississippi and Ohio rivers by barge.

The new facilities will include a two-stage distillation unit, laboratory, administration building, and four tanks with a cumulative storage capacity of about 1,100,000 bbl. Also, it will have necessary shipping and loading installations.

Presently, the company has 12 plants which produce bitumuls emulsified asphalt. Also, it has five asphalt refineries located at Seattle, Portland, Baltimore, East Providence, and Mobile.

Lion Oil Pushes $5,000,000 Refinery-Expansion Project

EL DORADO, Ark.—Lion Oil Co. is pushing construction on a $5,000,000 expansion program which calls for erection of a new catalytic cracker, an alkylation unit, vapor-recovery plant, and various auxiliary facilities at its 22,000-bbl. refinery here.

Company officials report that foundations have been laid and necessary equipment and materials for the new units have arrived. All the facilities are expected to be completed and on stream within 3 months. The refinery's crude-charging capacity will be increased by 1,500 bbl. by the expansion project.

State Auto Taxes to Exceed $3.2 Billion This Year

NEW YORK.—American motorists and other highway users will pay approximately $3,256,000,000 in state automotive taxes during 1953, according to a report issued here recently by the American Petroleum Industries Committee of the American Petroleum Institute.

The study revealed that the states will collect $2,066,000,000 in gasoline taxes and $1,190,000,000 in state motor license fees and special vehicle taxes. The sum of these two figures is 5 per cent higher than the total state highway revenue last year, and 55 per cent more than the amount collected in 1948.

In addition, the committee's report stated that the 1953 total shows that automotive revenue has more than doubled since 1946, tripled since 1936, and quadrupled since 1929.

The survey did not include $2,000,000,000 the federal Government collects in excise taxes on automobiles, parts, accessories, oil and motor fuel. However, it was pointed out that the 2-cent federal gasoline tax cost the public $851,000,000 in 1952.

Refining Briefs

WARREN, Pa. — United Refining Co. has placed a 2,500-bbl. per day catalytic reforming unit on stream at its 5,500-bbl. refinery here. The unit was erected by Blaw-Knox Co. under license from Atlantic Refining Co.

ROUSEVILLE, Pa. — Pennzoil Co. plans a $2,500,000 expansion program at its 8,500-bbl. refinery here which includes construction of a 9,000-bbl. crude-distillation unit and two boilers. Work will begin this week with completion of the entire project expected in early July.

Petrochemicals

A.P.I. Ready to Distribute New Toxological Series

NEW YORK.—Another series of toxological reviews of substances used or produced in the oil industry, is now available from the American Petroleum Institute. Designed for reference use by oil and chemical companies, these reviews are of special significance to refiners who need accurate and concise information on toxicity of many new chemicals and petroleum fractions handled today.

A total of 31 substances are included in the latest series. They include: acetic acid, acetone, ammonium molybdate, ammonium nitrate, amyl acetate, aromatic solvent naphtha, beta-naphthol, butadiene, butyl acetate, car-

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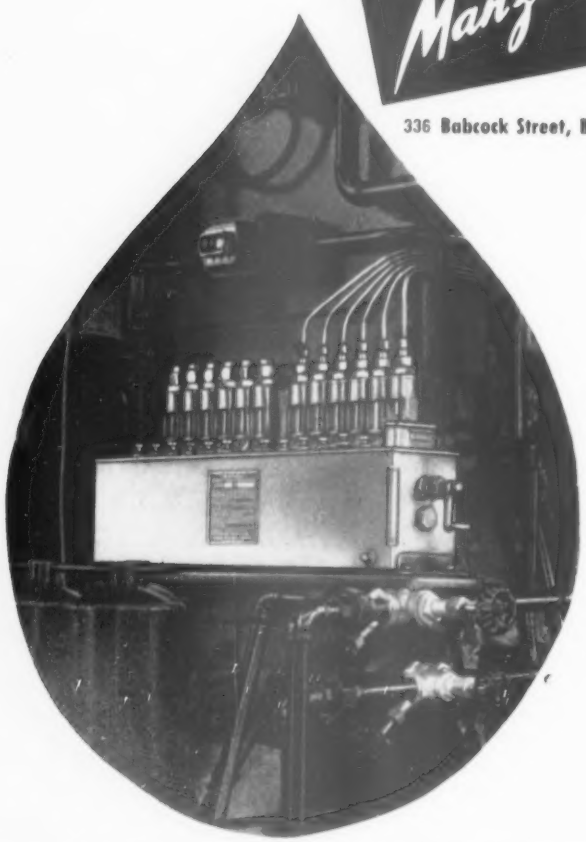

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The new series supplements two earlier ones issued in 1948, and the API now has available reviews on 63 toxic substances.

Individual reviews on the 31 new substances are available from the A.P.I. 50 West 50th St., New York for 25 cents each. The entire series of 31 costs $6.50 and all three sets $13.

Shell Cuts Glycerin Price

NEW YORK.—Shell Chemical Co. last week reduced the price of synthetic glycerin 3½ cents a pound. USP grade in tank-car lots was announced at 40½ cents, and other grades in tanks and drums were reduced by the same amount.

This is the first instance of a price reduction for glycerin originating with synthetic produce. Prices for natural glycerin followed to the lower level. Shell Chemical announced recently that new facilities will be built at Norco, La., to produce sufficient intermediate petrochemicals to boost the company's glycerin production by 25,000,000 lb. per year.

Cresylic Acid Demand Rises

NEW YORK. — Due to increasing consumption for gasoline additive and phenolic resin manufacture, cresylic acid is enjoying a brisk demand. The principal new use is for tricresyl phosphate, the TCP in Shell Oil Co.'s new premium grade gasoline, which takes about one ounce of the compound per 10 gal. of fuel.

Recent bulk receipts of cresylic acid from England have had no effect on the domestic market price, which remains at 73 cents per gallon for bulk quantities, and 75 cents for acid in drums. A number of petroleum refiners produce crude cresylic acid for sale. Last year's production of crude cresylic acid from petroleum sources was 14,317,000 lb., a decline from the 20,386,000 lb. produced in 1951. Many refiners equipped to separate and market cresylic acid as a byproduct of refining, have in the past found the market insufficiently attractive to pursue.

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President, Lockheed Aircraft Corporation

National Chairman, 1953 Aircraft Industry Payroll Savings Drive

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Lockheed Aircraft Corporation recently conducted a person-to-person canvass that put a Payroll Savings Application Blank in the hands of every employee of Lockheed's eleven plants in Southern California. At the conclusion of this one-week campaign, 36,419 of the 38,037 employees—95.7%—had signed up on the Payroll Savings Plan. Three of the eleven plants achieved 100% enrollment.

Lockheed's 95.7% in the Southern California plants is the highest employee participation of any company or group of this size this year. The previous national record in the aviation industry—92%—was set by Lockheed's Georgia Division in April, 1953. Of Lockheed's total payroll—50,000 men and women—94.9% are building ". . . security—both individual and national" by systematic investment in U.S. Savings Bonds.

45,000 companies operate Payroll Savings Plans. In many of these companies employee participation ranges from 60% to 80%; in some, it is even higher. On the basis of Payroll Savings Records, it is safe to estimate that 60% or more of the personnel of a company will join the Payroll Savings Plan—

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EXPLORATION

Rockies Are Top Future Province

by Philip C. Ingalls

THE intermontane basins of the Rocky Mountains and those basins of the Great Plains immediately to the east of the Rockies offer the greatest undeveloped oil country in the United States" — that's the way this issue of the Journal introduces a special section on "The Rocky Mountains . . . a beckoning frontier for the American oil industry."

That statement may be challenged by some geologists.

There are two undeveloped provinces with areal extent comparable to that of the Rocky Mountains and the contiguous Great Plains' basins to the east. They are: (1) the Continental Shelf and (2) the southeastern states. Neither of these provinces, however, is currently attracting the all-out effort directed at the Rocky Mountains.

The Continental Shelf . . . Just how important the 278,000 sq. miles of the United States' Continental Shelf will ultimately prove in terms of oil and gas reserves is for the most part pure speculation because of limited geologic information.

Portions of the submerged areas adjacent to the productive basins of coastal California have been proved by drilling from piers and directionally from shore. Per acre recoveries are extremely high but economical drilling for the next few years is expected to be restricted to an area of only 300 sq. miles.

A most promising area for the development of potential Continental Shelf reserves lies off the coasts of Louisiana and Texas in the Gulf of Mexico. Limited subsurface studies point to offshore Louisiana as the most favorable portion of this area. Though perhaps as much as 40,000 sq. miles of submerged area may be considered probable oil country, the expense and problems of offshore oil development will probably restrict development to an area of less than 15,000 sq. miles during the next few years.

Only a small percentage of this Gulf of Mexico area has been proved to include the prolific objectives found along the coast. Another 5 years or so will be required for geologists to confidently predict the actual potentialities of the Continental Shelf of this area.

Southeastern states . . . A potentially productive province extends from western Tennessee southward and eastward around the southwestern end of the Appalachian Mountains in Alabama and Georgia to the southern tip of Florida. Mississippi has a few pools, Alabama fewer, and Florida only one. In other words, this big sweep of territory has yet to prove itself as attractive oil country.

The recent indicated discovery of oil in Cambro-Ordovician rocks of northeastern Mississippi (see page 166) has already spurred interest in the immediate area and may be the forerunner of development throughout an until-recently neglected area.

The Rockies . . . Though drilling activity in the Rocky Mountains has been increasing rapidly since World War II, this extensive area is just warming up.

Most of the basins in the Rockies have been proved productive of oil and gas. Many of these basins are deep —no one knows just how deep. Several go way down below the current 20,000-ft. "basement." These basins offer known producing rocks all of the way down—oil has been found throughout the geologic column from Cambrian to Tertiary in the Rockies.

The cream of the Rockies has not been taken as in other areas that have been producing as long. The obvious big, surface-expressed structures have been drilled, but there is every reason to believe that there remain many oil-bearing structures that can be found by subsurface studies and the comparatively unused seismograph. Fields such as Rangely, Salt Creek, and Elk Basin must have their counterparts in Tertiary-masked areas.

A promising future for the big Williston basin appears more assured day by day. Though per acre recoveries may not approach those of some of the older producing areas, they are high enough to be economically attractive and the basin offers a great expanse of easily accessible area to compensate for the difference.

Judging from the rapid buildup of exploratory forces in the Rocky Mountain area, geologic thinking today points to the Rockies as the best nut to crack in the immediate future.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

MISSISSIPPI . . . Oil has been recovered on drill-stem test near the top of the Knox dolomite (Cambro-Ordovician) at Magnolia Petroleum Co. 1-A Snow, 27-13s-7e, Monroe County in the Black Warrior basin. Recovery on test at 4,747-64 ft. was 2,075 ft. of 35°-gravity oil and 25 ft. of oil-cut mud. This indicated discovery is one of the most significant developments in the Southeast in recent years. (See page 166).

WYOMING . . . W. F. Hammond has completed 1 Gaskill, NE NW SE 14-41n-66w, Cheyenne River area Newcastle discovery, with a flow gage of 1,500 bbl. of oil per day on ½-in. choke. The Weston County strike is about 4 miles south of the recent Black Thunder Creek discovery.

SAN JUAN BASIN . . . Magnolia Petroleum Co. recovered oil on drill-stem test at a wildcat along the southeastern flank of the San Juan basin for the first indicated production in that area. The oil was reportedly recovered in the Entrada.

COLORADO . . . Anderson-Prichard Oil Corp. is coring below 6,142 ft. at 1 Government "A," SE SE SE 17-4n-95w, apparent Morrison discovery in the Temple Canyon area of Moffat County. The indicated strike made 3,800 ft. of 50 per cent oil-cut mud on 1-hour test of the Morrison at 6,002-34 ft.

WILDCAT COMPLETIONS, JULY 1953

	Total	Oil	Gas	Dry	Footage	1953 Total comp.	1953 Cum. (1,000 ft.)	1952 Total comp.	1952 Cum. (1,000 ft.)
Kansas	78	8	3	67	298,968	537	2,021	498	1,928
Oklahoma	73	13	4	56	277,134	468	1,998	428	2,034
Texas	543	98	20	425	2,746,635	3,155	15,353	2,875	13,748
North Central	228	44	1	183	859,196	1,294	4,606	1,279	4,313
West	80	22	4	54	468,965	498	2,895	514	2,969
Panhandle	1	0	0	1	9,145	18	98	36	239
East	30	1	1	28	156,889	184	900	136	777
Gulf Coast	98	19	9	70	735,830	538	3,851	411	3,141
Southwest	106	12	5	89	516,610	623	3,003	499	2,309
Louisiana	45	18	3	24	435,319	280	2,481	206	1,816
North	13	2	0	11	79,393	81	461	87	510
South	32	16	3	13	355,926	199	2,020	119	1,306
Mississippi	21	1	0	20	152,205	124	886	107	788
Arkansas	28	2	0	26	74,188	72	249	48	212
Nebraska	16	1	1	14	80,575	98	502	76	316
Rocky Mountains	65	4	3	58	365,550	353	2,019	243	1,342
Dakotas	13	4	0	9	77,824	44	259	14	101
New Mexico	9	3	0	6	67,248	85	553	93	593
California	50	6	2	42	367,362	375	1,876	335	1,550
Tri-States	117	3	0	114	215,238	562	1,114	732	1,533
Others	56	2	3	51	181,732	270	911	304	898
Total July 1953	1,114	163	39	912	5,339,978	6,423	30,222	5,959	26,859
Total June 1953	870	127	21	722	4,054,331				
Cumulative 1953	6,423	937	232	5,254	30,221,756	6,423	30,222		
Cumulative 1952	5,959	903	150	4,906	26,858,602			5,959	26,859

Wildcat Completions Soar to New High

by John C. McCaslin

JULY wildcat completions in the United States hit a new all-time high for any one month, up 28 per cent over the previous month. Cumulative wildcats drilled for 1953 show an 8 per cent gain over last year. Wildcatters have finaled 937 new oil discoveries, 232 gas strikes, and 5,254 dry holes this year. More than 30,000,000 ft. of hole has been dug to make this record.

All areas except Louisiana, Nebraska, and California reported increases in wildcat completions in July. Texas completions showed a healthy 36 per cent gain over the previous month. Mid-summer saw wildcat activity in the Rocky Mountains and the Dakotas surge to the year's highest levels. An important Cambrian discovery in West Central Texas and renewed interest in the eastern rim of the Powder River basin highlighted the month's activities.

Cambrian production . . . Another discovery in the Wilberns dolomite of Upper Cambrian age promises to have a far-reaching effect on deep exploration in North and West Central Texas.

American Trading & Production Corp. 2 Little, in White Flat field, Nolan County, has been completed for a calculated daily flowing potential of 1,870 bbl. of 46° -gravity oil in a thick, highly permeable Wilberns dolomite section. This Wilberns discovery becomes the seventh pay in White Flat field. The original Cambrian discovery in the field produced from the Hickory sand (Lower Cambrian). Earlier this year Humble Oil & Refining Co. completed a Cambrian producer in North Bronte field, Coke County. Originally, the pay sand was identified as the Hickory, but was later corrected to Wilberns after paleontological studies.

Very little is known of Cambrian rocks, but recent studies have established that the Wilberns dolomite is a distinct section apart from the Ellenburger group. The greater part of North Central Texas is underlain by a sequence of dolomites and limestones of Lower and Upper Cambrian age, at depths ranging from 1,000 to 11,000 ft. Further drilling will evaluate the significance of these recent Cambrian discoveries.

Cambrian production is limited to Texas, Kansas, and Wyoming. In Montana Premier Petroleum Co. recently let contract to drill for possible Cambrian production in the Hot Springs area of Sanders County in a large untested area west of the Rockies. The wildcat will be drilled in a mountain valley with undetermined amounts of Tertiary deposition overlying Cambrian. With the exception of some very shallow gas exploration years ago this wildcat is the first drilling in the portion of Montana west of the Rockies. Lost Soldier and Wertz fields in Wyoming are the only areas in the Rocky Mountains with Cambrian production.

Powder River basin . . . Renewed interest in the development of the eastern rim of the Powder River basin in Weston County, Wyoming, is the result of three significant discoveries this year.

The first strike was made by Big Horn-Powder River Corp. and J. D. Sprecher at 1 Wakeman, NE NW NE 1-42n-66w, which flowed 975 bbl. of oil per day from the Newcastle sand at 6,678-84 ft., opening a new field about 2½ miles southwest of Clareton production. Additional drilling in the area has resulted in three more flowing wells for the new pool.

Early last spring Voss Oil Co. opened a new producing area in Weston County's Black Thunder Creek area, 2½ miles southwest of the Southwest Clareton discovery. This pool opener was completed for 250 bbl. of oil per day on pump. Offsets and extensions to this new pool have met with excellent success. R. L. Manning 1 Sedgwick, a ½-mile south stepout, had an initial flow gage of 1,425 bbl. of oil per day on ¾-in. choke.

In July Mars Drilling Co. made a discovery about 2 miles from Newcastle in Weston County, about 2½ miles east of Skull Creek production. The strike is located on the extreme eastern flank of the Powder River basin, and was also completed in the Newcastle sand. The second well in the pool found water in the Newcastle, but the third well has indicated an excellent sand section.

Total Completions Set Record

by John C. McCaslin

JULY total completions in the United States hit a new all-time high for any one month, up 23 per cent over the previous month. Cumulative total completions show a 2 per cent gain over last year. Total completions for the first 6 months of 1953 were about the same as last year, but the big July increase has pushed the year's total ahead, promising that the last half of the current year will set new drilling records in the nation.

Wyoming and New Mexico were the only two areas reporting drilling decreases for the month. Texas completions showed a healthy 24 per cent gain over the previous month. Oklahoma had a record month in total wells drilled. Seasonal increases in the Rocky Mountain area pushed completions to the year's record levels. New oil successes are running slightly under last year's totals, but gas wells and dry holes are up considerably. Total footage has pulled ahead of last year for the first time in 1953. The slowdown in West Texas drilling this year has brought the number of wells drilled in the 5,000-7,500, 7,500-10,000, and 10,000-12,500-ft. classification down under previous year for the first time in recent years. Increases in South Louisiana deep-well completions have raised the over-12,500-ft. classification by 20 per cent. In comparison with last year the shallow classifications are showing considerable increases.

The Denver-Julesburg basin continues to be the most active area in the Rocky Mountains, particularly in the Little Beaver and Doran field areas. Blanco gas development is the center of northern New Mexico interest, while the East Poplar area of eastern Montana leads that state's activity. The East Poplar area has four wells nearing completion, three new locations reported, and three wells drilling in this portion of the Williston basin. Renewed interest in northwestern Montana's border area is reported this summer following new discoveries.

Monthly completions in Oklahoma promise a record year for that state. Lincoln County in Central Oklahoma has led the state's development and wildcat program consistently in 1953. Drilling increases are reported in the state's older southern and northern producing areas. All through Central Oklahoma new discoveries are being evaluated and extended, and revival programs are under way.

SUMMARY OF COMPLETIONS, JULY 1953

	Total comp.	Oil	Gas	Dry	Under 2,500 ft.	2,500-5,000 ft.	5,000-7,500 ft.	7,500-10,000 ft.	10,000-12,500 ft.	Over 12,500 ft.	Total footage	Rigs and drilling
New York	56	28	0	28	56	0	0	0	0	0	86,400	55
Pennsylvania	130	56	25	49	106	7	17	0	0	0	320,418	115
West Virginia	58	8	34	16	32	26	0	0	0	0	148,866	168
Ohio	90	37	11	42	50	39	1	0	0	0	183,890	181
Kentucky	109	46	11	52	72	37	0	0	0	0	224,812	102
Illinois	218	103	0	115	81	137	0	0	0	0	542,546	346
Indiana	149	49	0	100	135	14	0	0	0	0	232,138	169
Michigan	72	29	2	41	48	19	5	0	0	0	171,161	113
Kansas	459	231	35	193	49	403	7	0	0	0	1,561,309	443
Nebraska	34	11	1	22	0	18	15	1	0	0	175,323	31
Oklahoma	740	459	41	240	251	360	91	34	4	0	2,449,952	1,098
Texas	1,680	920	108	652	403	612	446	157	49	13	7,758,894	1,272
N. Central (Dist. 7-B & 9)	700	394	6	300	270	271	155	3	1	0	2,390,909	318
West (Dist. 7-C & 8)	321	230	6	85	43	133	87	24	21	13	1,713,762	429
Panhandle (Dist. 10)	69	32	30	7	11	57	0	1	0	0	217,171	64
East (Dist. 5 & 6)	70	19	12	39	13	20	27	10	0	0	350,682	89
Gulf Coast (Dist. 2 & 3)	261	120	34	107	14	56	81	87	23	0	1,780,391	212
Southwest (Dist. 1 & 4)	259	125	20	114	52	75	96	32	4	0	1,305,979	160
Louisiana	261	161	17	83	61	34	31	60	59	16	1,839,481	319
North	115	68	5	42	58	22	25	8	2	0	407,173	119
South	146	93	12	41	3	12	6	52	57	16	1,432,308	200
Arkansas	65	26	0	39	20	38	7	0	0	0	196,443	56
Mississippi	40	14	1	25	0	5	20	10	5	0	289,450	33
Ala.-Ga.-Fla.	16	1	0	15	2	7	6	0	0	1	80,353	11
Montana	42	15	3	24	14	13	5	9	1	0	193,163	82
Wyoming	61	42	1	18	6	26	23	4	2	0	315,272	240
Colorado	63	19	9	35	3	19	37	4	0	0	315,513	102
Utah	6	2	2	2	1	1	4	0	0	0	30,691	24
New Mexico	101	46	43	12	16	30	33	8	8	6	574,726	237
California	208	153	4	51	58	81	31	24	12	2	1,021,661	255
North Dakota	20	12	0	8	0	6	0	14	0	0	138,955	36
Miscellaneous	58	0	1	7	2	4	2	0	0	0	29,457	¶25
Total July 1953	4,686	†2,468	349	*1,869	1,446	1,936	781	325	140	38	18,880,874	‡5,513
Total June 1953	3,799	1,973	285	1,541	1,175	1,541	684	267	103	29	15,326,712	4,687
Cumulative 1953	27,869	14,446	2,172	11,251	8,341	11,623	4,845	2,023	797	240	113,583,900	
Cumulative 1952	27,337	14,601	1,838	10,898	8,290	10,905	5,018	2,110	815	199	112,742,814	
Western Canada	228	119	19	90	42	126	50	7	3	0	897,434	
Alberta	144	78	16	50	24	65	47	6	2	0	605,723	
Saskatchewan	68	31	0	37	12	52	3	1	0	0	236,996	
Manitoba	11	10	0	1	6	5	0	0	0	0	27,666	
British Columbia	4	0	3	1	0	3	0	0	1	0	24,271	
N.W.T.	1	0	0	1	0	1	0	0	0	0	2,778	
Western Canada—June	206	118	16	72	33	106	61	5	1	0	839,973	

*Incl. 110 service wells: N. Y. 28, Pa. 42, Ohio 11, Kans. 6, Okla. 11, N.C. Tex. 9, W. Tex. 2, S.W. Tex. 1. †Incl. 42 condensate wells: Okla. 5, N. Tex. 1, W. Tex. 1, Tex. Gulf 15, S.W. Tex. 2, S. La. 14, Miss. 4. ‡Incl. all wells rigged up and/or drilling at month end. §Md. 1 gas, 7,238 ft.; S. D. 3 dry, 12,571 ft.; Ariz. 1 dry, 4,523 ft.; Idaho 1 dry, 2,800 ft.; Nev. 1 dry, 1,025 ft.; Tenn. 1 dry, 1,300 ft. ¶Incl. Md. 4, S. D. 8, Idaho 2, Nev. 6, Tenn. 5.

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MISSISSIPPI

Knox Discovery to Spur Mississippi Exploration

Discovery of Cambrian-Ordovician oil in the Black Warrior basin of northeastern Mississippi and northwestern Alabama is revealing new potentialities and providing additional stimulus for continued exploration throughout that region, scene of active Mississippian-Chester exploitation the past year and a half.

The discovery, made by Magnolia Petroleum Co. at its 1-A Snow, a rank wildcat, located near the C NW NE 27-13s-7e, approximately 7 miles north and a little west of Aberdeen, in western Monroe County, Mississippi, generally is regarded as one of the most significant in recent years in any of the southeastern states.

Portion of northeastern Mississippi sector of Black Warrior basin showing location (black arrow) of Magnolia Petroleum Co.'s Knox dolomite-oil discovery well in Monroe County, and the area's five Mississippian-Chester gas and gas-distillate fields discovered within the past year and a half.

Although the well, as this is written, has not been completed, showings and results of drill-stem tests are considered virtually conclusive of commercial production.

With top of the Ordovician logged just below 4,330 ft., hole was carried to 4,769 ft. in the upper Cambrian. Oil shows were noted in mud logging from 4,756 ft., and, in a 75-minute drill-stem test run at 4,764 ft., taking in the interval from 4,747 ft., the well filled 2,075 ft. of 35°-gravity oil, plus 35 ft. of oil-cut mud. The test got gas at the surface within 39 minutes. Bottom-hole pressure was recorded at 210 to 445 psi. flowing, and 1,920 psi. shut-in.

A test of the bottom 5 ft. of hole (4,764-69 ft.) yielded 360 ft. of clean oil and 30 ft. of oil-cut mud with 270 ft. of water. Bottom-hole pressure was 35 to 180 psi. flowing, and 1,185 psi. shut-in. Following this test, 7-in. oil-string casing was run for production tests.

The indicated producing interval is reported as being in the Knox dolomite, the approximate equivalent of the prolific Ellenburger horizon of West Texas, and the Arbuckle of Kansas and Oklahoma, both of lower Ordovician and upper Cambrian age.

Knox dolomite is the top member of the Knox (or Knoxville) group, known to extend over Tennessee, southern Kentucky, western North Carolina, northwestern Georgia, and northern Alabama and Mississippi. It overlies the Knox (Conasauga) shale, and underlies the Trenton, or Lebanon (Stones River) group.

Some small production has been found in

the Knox in southern Kentucky and northern Tennessee, where the formation is at shallow depths, but, otherwise, particularly in the Black Warrior basin, drilling to this formation has been limited to a few scattered tests. One of these, however, was the discovery well of the Aberdeen field, approximately 7 miles southwest of the Magniolia discovery. Before its completion early this year as a gas producer in the Sanders zone of Mississippian-Chester age at a depth of 3,500 ft., it was drilled to a total depth of 6,122 ft., approximately 750 ft. in the Knox, encountering tight dolomite and limestone with no shows.

Magnolia's well logged top of the Mississippian at 2,012 ft. with surface elevation of 298 ft. It also recorded shows in the Carter zone, topped at 2,491 ft., and the Sanders zone, topped at 2,565 ft. Drill-stem tests in these zones, principal productive horizons of the gas and gas-distillate fields so far discovered in the northeastern Mississippi portion of the Black Warrior basin, were not encouraging.

The discovery by Magnolia comes at a time of slackening of the extensive Mississippian-Chester exploratory play in the basin which started with the discovery of the Muldon gas-distillate field, in southwestern Monroe County, early in 1952. This exploration has resulted in the discovery of five fields (including Muldon), all in the northeastern Mississippi portion of the basin, two each in the adjoining Monroe and Chickasaw counties, and one in northeastern Clay County, which adjoins the above two counties on the south. In all this exploration, only a few tests were drilled through the Mississippian, and these, except for the Aberdeen discovery well, were stopped in the Devonian.

KANSAS

Oil Prospects on Northern Basin Shelf Show Promise

The prospects of finding oil in southern Kansas's Comanche County on the northern basin shelf of the Anadarko basin have brightened with the report that Barbara Oil Co. has found oil shows at 1 Kaminska (A on map), C SW 24-31s-16w, in the lower Morrow. The section was topped at 4,770 ft.

A drill-stem test at 4,771-85 ft. recovered 20 ft. of oil and gas-cut mud and 80 ft. of mud and gas-cut free oil. Another test at 4,876-97 ft. in the Mississippian recovered 20 ft. of slightly gas-cut mud and bottom-

Map of the northern basin shelf of the Anadarko basin which extends from Oklahoma into Clark, Comanche, and Barber counties, Kansas. The extreme southern tip of the Central Kansas uplift extends through Pratt County into the northwestern part of Barber County.

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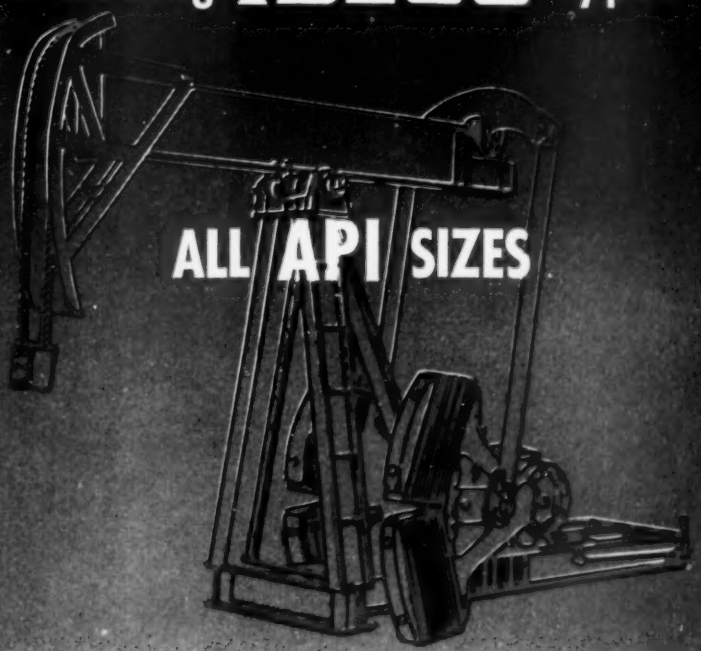

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hole pressure was 1,165 psi. Some gas-cut mud was recovered on a test at 4,900-31 ft.

If the prospective pay in this indicated strike is proved to be definitely Morrow it would extend the northeast limits of the Morrow further than has been heretofor recognized. Facies changes from basinal sands to platform limestones in the Pennsylvanian create a definite oil-producing possibility on this northern basin platform of the Anadarko basin which extends from Oklahoma into southern Kansas. Nearest Morrow production is at Snake Creek pool in Clark County, 40 miles to the southwest.

Robbins Ranch pool in this sector of the county was opened last spring at Barbara I Robbins, SE NE NW 23-31s-16w, with Mississippi open hole at 4,888-4,930 ft. gaging 6,800 M.c.f. of gas daily open flow. Later I Robbins Unit, C SE Section 23, was completed for 10,000 M.c.f. of gas per day. The area is 3 miles west of Skinner Southwest gas pool in Barber County which is a 1953 discovery, also. Robbins Ranch pool opened first gas production for Comanche County.

Elsewhere on the northern basin shelf J. M. Huber Corp. is planning a wildcat in 30-34s-19w, 12 mile east of Snake Creek pool in Comanche County at (B on map). Snake Creek pool (C on map) was opened last year with Morrow gas-distillate production. Another gas pool was opened this year just northwest of Snake Creek.

MICHIGAN

A drill-stem test in the Richfield potential oil zone was reported to have showed no oil or gas at Carter Oil Co. 1 Lemcool, SE SW SW 9-25n-10w, Paradise Township deep test wildcat, Grand Traverse County. Well was being drilled below 3,805 ft. en route to its objective Niagaran horizon at about 7,300 ft.

Carter, this week, was rigging up rotary tools for another 6,500-ft. Niagaran test in Grand Traverse County. New start, about 12 miles northwest of the 1 Lemcool, was announced for the 1 Schmidt, SE SE NE 25-26n-12w, Greenlake Township. Union Rotary Corp. is contractor on both of these wildcats.

Also during the past week, Carter announced another Niagaran objective test for Michigan, across the state to the south in Hillsdale County. New southern Michigan wildcat, scheduled to be drilled to about 2,700 ft. to test the Niagaran, will be at the 1 Johnson, NE NE SE 7-5s-4w. Rotary tools will be moved to location in the near future. The announcement of these two new wildcats brought the total of important deeper horizon tests either being drilled by Carter or with announced intentions to drill this summer to four.

The Michigan Department of Conservation, during the week of August 8 to 14, approved 19 new drilling permits, 12 of which were for wildcats. Wildcat wells were announced for: Standish Township, Arenac County; Gibson Township, Bay County; Marcellus Township, Cass County; Bentley Township, Gladwin County; Greenlake Township Grand Traverse County; Woodbridge Township, Hillsdale County; Cambridge Township, Lenawee County; Briley Township, Montmorency County; Jonesfield Township, Saginaw County; and for Decatur, Lawrence and Porter townships, Van Buren County.

ARKANSAS

New Pool Opened in Columbia County

Mid-Continent Petroleum Co. has a new Pettit discovery ⅜ mile northwest of Welcome in Columbia County, 1¼ miles northnorthwest of Springhill field's one Hill sand well.

Pumping rate at the well is estimated at 200 bbl. per day. Pay is Pettit perforations at 6,004-12, 6,026-32, and 6,057-63 ft. after acid treatment.

LOUISIANA

NORTH LOUISIANA

Wilcox Discovery Finaled West of Fairview Field

Concordia Parish in eastern Louisiana's Wilcox trend area has a new discovery at Carter Oil Co. 2 Orrin James, 26-4n-9e, 2 miles of Fairfield field.

Production is from perforations at 6,747-49 ft. in the second of five oil pay sands. The discovery flowed 192 bbl. of 47°-gravity oil per day through 10/64-in. choke. The new strike is located on Roseland plantation.

Tensas Discovery Finaled On Harper's Island

Heep Oil Corp. and associates have completed a discovery on Harper's Island at 1 Magnolia-Learned, 10n-12e. The strike, opening Harper's Island field, flowed 166 bbl.

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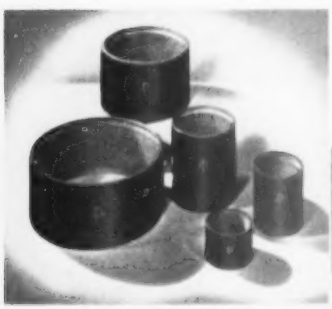

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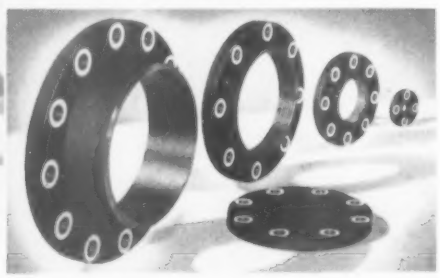

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of oil per day through ½-in. choke. Production is from perforations at 9,252-60 ft. in the Massive sand of lower Tuscaloosa. This pool opener is located about 4½ miles southeast of Locust Ridge and 5 miles west of Rodney field in Jefferson County, Mississippi. A 660-ft. north offset to the discovery is under way at 1 Sohio-Learned.

CANADA

Three Discoveries Due Western Canada Region

There were three indicated discoveries in western Canada during the past week chalked up at two wildcats, both in Alberta. One of those exploratory drillers found both gas and oil, while the other found only natural gas.

The 1953 discovery tally, with 7 months and 3 weeks of operations now passed, stands at 83 indicated oil and/or natural gas discoveries for western Canada. Among those are 50 that gave up oil and 33 recorded as gas strikes. All those ventures will not finally tally as commercial producers, some may result in major finds, but the larger percentage will probably be small reserves of oil or gas.

Nearly 75 per cent of the indicated strikes so far in 1953 were made in Alberta, where the major portion of Canada's petroleum exploratory operations are under way. That percentage includes 35 that gave up oil and 27 that found natural gas.

Saskatchewan's tally stands at 16 new 1953 finds, comprised of 13 oil and 3 natural gas. British Columbia has accounted for one oil strike and three gas finds; while Manitoba has recorded only one oil discovery so far this year.

Wood River . . . The most significant discovery during the past 7-day period was made by Texaco Exploration Co. at its wildcat in the Wood River area of central Alberta, 10 miles east of Ponoka town and 115 miles north and northeast of Calgary. This exploratory venture found both a sizable flow of natural gas and some light gravity oil in the basal quartz section of the Lower Cretaceous.

Texaco A-1 Wood River, LSD 9, 6-43-23w4, entered the basal sand at 4,902 ft. Initial drill-stem tests gave up gas flow rates ranging from 4,620,000 to 3,200,000 cu. ft. daily, plus small recoveries of distillate and light gravity crude oil. During test of the interval 4,991-97 ft. the well flowed gas at rate 646,000 cu. ft. per day and also flowed 39.5°-gravity crude oil at estimated rate of 200 bbl. daily. Pipe recovery on that test was comprised of 300 ft. of oil and 60 ft. of salt water. Latest test gave up only formation water, indicating that a thin oil pay zone was present, probably from 5 to 10 ft. in thickness. Crew is currently heading down for lower objectives, and is drilling below 5,100 ft.

The week's other discovery was made by Sinclair Canada Oil Co., Canadian operating unit of the U. S. Sinclair Oil Co. Sinclair's Crown 1 V. Baxandall wildcat, LSD 4, 8-60-1w5, discovered natural gas in the Viking sand, and at week's end had penetrated 44 ft. of Viking zone without encountering any formation water. Drill-stem tests between 2,471 and 2,523 ft. flowed natural gas at rates ranging from 1,295,000 and 2,000,000 cu. ft. daily. Hole is currently being deepened.

The well is some 45 miles northwest of Edmonton and 8 miles south of other gas discovery wells in that general region of Alberta.

OKLAHOMA

New Producer Tested At Northeast Purdy

Both the Springer and Hart sands are showing on initial production tests at Magnolia Petroleum Co. 1 Duncan-Neill, C NE SW 7-3n-3w, extending pay in the Northeast Purdy area of Garvin County.

The Springer was perforated at 9,038 ft. to 9,120 ft. to flow 753 bbl. of 40°-gravity oil per day through a 24/64-in. choke. Perforations in the Hart at 8,441-63 ft. flowed 220 bbl. of oil in 14 hours through a ¾-in. choke. Oil was 41°-gravity. More Hart pay will be perforated prior to completion.

Magnolia completed one of two zones found at 1 Sweet, C NE SW 2-3n-4w, on the west side of Northeast Purdy, the Hart sand. The well flowed 145 bbl. of oil per day through ½-in. choke from perforations at 8,668-73 ft. after treatment. Gas-oil ratio was 2,947:1. Springer perforations at 9,752 to 9,812 ft. will be tested.

Phillips Petroleum Co. 1 Charlie-A, C NE NE 18-3n-3w, on the north side of the field, flowed 259 bbl. of oil in 14 hours through ¼-in. choke from the Hart sand at 8,296 to 8,364 ft. and the Springer at 8,876 to 8,910 ft.

Northeast Purdy pool was opened in 1952 at Magnolia 1 Duncan-Alcorn unit, NE NE SE 1-3n-4w. The Springer discovery well flowed 566 bbl. of oil per day. The Hart sand discovery well was Superior Oil Co. 1 Aris Arner, in 7-3n-3w, which was completed for 55 bbl. of oil per day through 20/64-in. choke.

Cities Service Oil Co. and Superior Oil Co.

In the heart of the Leduc-Woodbend field, Devon Branch has been in operation since 1949.

This branch has served oil men in the Turner Valley area for more than 20 years. (above)

Leduc Branch was opened in 1947, the day after the first producing well was brought in. (left)

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are running casing to complete a ¼-mile extension to Northeast Purdy pool in Garvin County. The 1 Bridwell, C SE NW 2-3n-4w, had Hart sand pay indicated at 8,640-70 and from 8,700-10 ft. Springer sand pay was also indicated from 9,690 to 9,764 ft. This is Cities Service's 11th well in the new Springer sand trend. The company now has five wells under way in the Northeast Purdy area.

Garfield Discovery Is Completed in Layton

Cities Service Oil Co. has a lower Layton sand discovery at 1 Lewis "B," C NW NE 32-21n-3w, about 15 miles west of Perry in Garfield County. The well flowed at the rate of 168 bbl. of oil per day through 25/64-in. choke from perforations at 4,786-4,805 ft. after fracture treatment.

The new Layton pool is 5 miles west of North Lucien pool, which is the nearest production.

Fourth Well at Southwest Navina Goes on Production

Production has been assured the Macmillan Petroleum Corp. et al 2 Krout in Southwest Navina pool, Logan County, following production tests which developed 2,666 M.c.f. of gas and 60 bbl. of 61°-gravity distillate in 20 hours on a 20/64-in. choke.

Production was reached in the Layton sand from a 3-ft. interval out of a total of 17 ft. of sand at a depth of 5,114-17 ft. following several weeks awaiting final production tests. Tubing pressure was 825 psi. and the cut was less than 2 per cent.

This makes the fourth producing well in the Logan County field for Macmillan et al, and the first producer from the Layton sand which is the third zone yielding production in this pool. In the 4 Krout, a producing interval was found in the Layton sand, but the well was drilled to the second Wilcox sand and placed on open hole production from that zone. Production is also being obtained from 1 Berg, producing in the Simpson dolomite.

Another Prue Sand Strike in Lincoln

Lincoln County in central Oklahoma, consistently the state's most active area this year, has another Prue sand discovery at Puckett Drilling Co. 1 Harlow, SW NW NW 34-14n-6e.

The well flowed 60 bbl. of oil per hour on a smaller than 1-in. choke after fracture treatment. The casing is perforated at 3,096-3,122 ft.

Between East Parkland and Northwest Kendrick pools Zephyr Petroleum Co. has casing set at 1 Simonton, NW NE NW 32-16n-5e. This area was recently opened to production with the completion of Zephyr's 1 Swigart in the NE NW NW Section 32. Flow was 100 bbl. of oil per day from the Prue sand with top at 3,522 ft.

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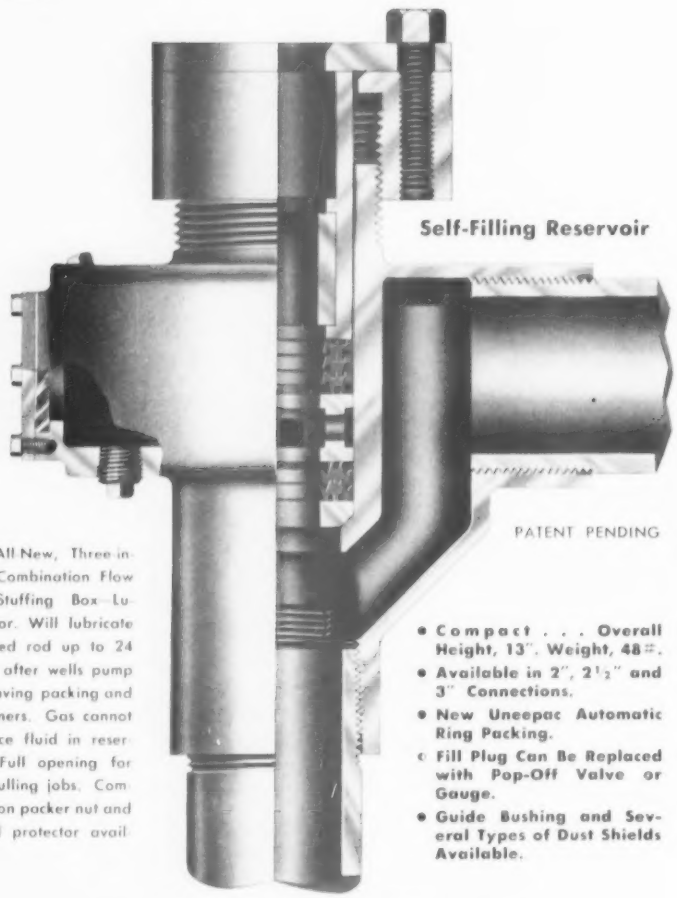

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TEXAS

WEST TEXAS

Dawson Reef Strike Logs Additional Oil

Seaboard Oil Co. 1 Herman Pettaway, southeast Dawson County Pennsylvanian reef discovery, has logged additional oil shows in coring to 8,183 ft. Total indicated pay section to that depth was 298 ft. Operators were reaming down before making a drill-stem test of the 50-ft. section cored. Previous drill-stem test between 8,083-8,133 ft. had oil in 14 minutes, which flowed 117 bbl. of oil and no water in 1 hour and 43 minutes.

Gulf Oil Corp. 1 Cannon, located about 8 miles northeast of the above strike, but in extreme western Borden County, reported oil recovery from the Siluro-Devonian. Drill-stem test from 10,270-10,365 ft., open 3 hours, developed 91 ft. of clean, 45° oil, 728 ft. of about half oil and mud, and 455 ft. of salt water.

North extension . . . Gulf Oil Corp. 2-D McElroy Ranch Co.-State, ½-mile north outpost to Adams Devonian pool of west Upton County, has completed for 573 bbl. of oil a day, based on a 6-hour test through ¾-in. choke. Pay section was perforated at intervals from 10,040-10,610 ft.

TEXAS GULF COAST

Woodbine Oil Production Opened at Fort Trinidad

Woodbine production has been opened in the Fort Trinidad field, on the Houston-Madison county line. The discovery well is Woodley Petroleum Co. and Moran Corp. 2 W. T. Bruton est., originally completed last June as a Georgetown lime producer at 9,152-66 ft. Due to water encroachment in the latter horizon, the well has been plugged back and recompleted with casing perforated at 8,690-8,712 ft. opposite the Dexter section of the Woodbine, previously indicated as

being productive but passed up in drilling to the Georgetown.

On potential test of the new pay, the well flowed at the rate of 214 bbl. of 37.5 -gravity oil per day through 9 64-in. choke. This gives the field three proved producing horizons, Woodbine at 8,700 ft., Buda lime at 9,015 ft., and Georgetown lime at 9,150 ft.

ROCKY MOUNTAIN

COLORADO

Morrison Discovery Indicated Northwest of Maudlin Gulch

Anderson-Prichard Oil Corp. has tested an apparent discovery in lower Morrison sands at 1-A Government, SE SE NE 17-4n-95w, Moffat County. The well is about 2 miles northwest of production in the Maudlin Gulch unit, and is outside the unit area. Production is found in both Morrison and Entrada in Maudlin Gulch field.

On test of the Anderson-Prichard well from 6,002-34 ft., the operator reported recovery of 3,800 ft. of clean 50 per cent oil-cut oil in 1 hour. Oil recovered was 32.5 gravity. The recovery also included 210 ft. of mud, slightly water cut. Flowing pressure was 160-815 psi., and shut-in pressure after 15 minutes was 1,870 psi.

Top of Dakota was logged at 5,642 ft., and top of Morrison at 5,998 ft. The operator is drilling ahead below 6,142 ft., after coring some shows in sand immediately below the tested zone, and wet sand below a substantial shale break at about 6,100 ft. The wildcat will test Entrada, expected at about 6,400 ft. The well is located on land farmed out to Anderson-Prichard by Stanolind Oil & Gas Co.

WYOMING

New Weston County Discovery Flows at High Rate

W. F. Hammond has announced a flow gage of 1,500 bbl. of oil per day through ½-in. choke at 1 Gaskill, NE NW SE 14-41n-66w, in the Cheyenne River area of southern Weston County. Flow was through perforations in Newcastle sand in the zone 7,036-51 ft. Top of Newcastle was logged at 7,009 ft., and total depth of the well is 7,150 ft.

The discovery is the most southerly yet made in the current program to extend production south and southwest from Clareton field. It is about 4 miles southwest of the discovery in the Black Thunder Creek area made earlier this year. The operator reports that at least five wells will be drilled in the immediate vicinity within the near future, but has announced no locations at the present time.

Cottonwood Creek Discovery Flowing

Stanolind Oil & Gas Co. has reported a flow at the rate of 167 bbl. of oil per day on tests of the apparent discovery, 1 Unit, C SW SW 2-47n-91w, first test of the Cottonwood Creek unit, Washakie County. Test was of perforations in Phosphoria at 7,290-94 ft. The interval was acidized with a total of 24,000 gal. in two equal treatments, and the well unloaded following the second acidization. A previous gage of 11 bbl. of oil per hour was reported. Stanolind is con-

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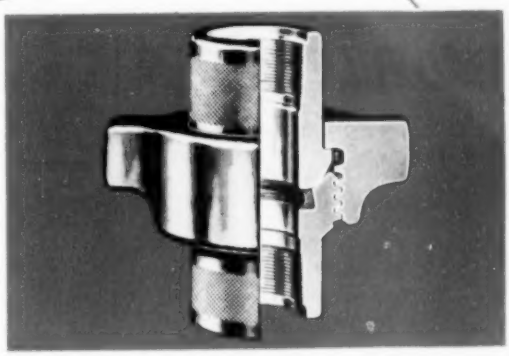

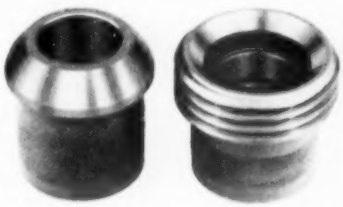

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tinuing to test following the recovery at the 167 bbl. per day rate. The discovery is south of Manderson and Bonanza fields on the east side of the Big Horn basin, and about 3 miles southwest of Hidden Dome.

Hot Springs County Wildcat Is Black Oil Discovery

Stanolind Oil & Gas Co. has recovered apparently commercial quantities of 18° gravity black oil on tests of Phosphoria at the 1 Unit, NW SW NW 25-45n-101w, in the Dickie unit, Hot Springs County. The recovery on 1-hour test 6,593-6,633 ft. was 1,200 ft. of clean oil. A second test of the zone 6,635-90 ft. recovered 3,240 ft. of clean oil, also in 1 hour. Cores through the Phosphoria were principally dolomite with black oil saturation, and some fractures.

The wildcat is scheduled to drill ahead to test Madison at about 7,000 ft. It is just west of Skeleton dome, a nonproductive surface feature of the southwestern flank of the Big Horn basin. The low gravity of the oil recovered is not in keeping with principal production through the area where production averages about 29° gravity.

South Sand Draw Discovery Being Completed

Sohio Petroleum Co. is running casing and preparing for completion tests at 1 Unit, SE NW SE 36-32n-95w, in the South Sand Draw area, Fremont County. Total depth was 8,792 ft., and the wildcat is apparently commercial in three zones. It made gas at the rate of 3 to 5 million cubic feet of gas per day from Frontier at 5,043-73 ft. and black oil from Phosphoria and upper Tensleep tests. Sohio has not reported the formation or formations in which completion is to be attempted, and has not released the casing point.

NORTH DAKOTA

McKenzie County Wildcat Logs Madison Show

Stanolind Oil & Gas Co. recovered 180 ft. of oil and oil and gas-cut water cushion on test of the zone 9,283-9,301 ft. at 1 Starr, C SW SE 21-152n-94w, McKenzie County. Core from 9,302-27 ft. was limestone, with good stain throughout. The operator is reported preparing to test this interval. The Mission Canyon was topped at 9,051 ft. in the wildcat which is scheduled as a 13,850-ft. test to Ordovician.

CALIFORNIA

Honolulu Completes Shallow Discovery Near McKittrick

Honolulu Oil Corp. completed 1 Honolulu-Watson-C.C.M.O. as a new Phacoides sand pool discovery in the Belgian Anticline area near McKittrick. Initial production was 275 bbl. of oil daily through a 19/64-in. choke, with perforations at 2,852-67 ft. Gravity of the crude was 37.

Located in NW SW 15-30s-21e, the new discovery is almost ½ mile southwest of the Oceanic sand discovery completed by Morriqui Exploration Co. last March. Honolulu carried its test to 4,954 ft. in search of the

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deeper pay but failed to find it. Moriqui 5 Anderson, an east offset to the Oceanic discovery, likewise was a failure at 3,850 ft.

Coles Levee Gas Find Indicated

Kern County Land Co. has set 5½-in. casing in 67-A K.C.Y., a test on its large holdings south of Coles Levee production in Kern County. Pipe was run after a formation test at 6,695-6,716 ft. resulted in a dry gas flow at the daily rate of 5,000 to 10,000 M.c.f. If successfully completed the outpost would be a new gas zone discovery.

Located in SW SE 12-31s-25e, 67-A is a follow-up to 67 K.C.Y. which blew outlast December when the operator perforated the interval 6,700-10 ft. The well was out of control for several days and after the casing collapsed it was abandoned.

APPALACHIAN AREA

WEST VIRGINIA

In Middle Fork district, Randolph County, West Virginia, Nollem Oil & Gas Corp., 2 Moore, Kepple & Co., wildcat, elevation 2,638 ft., received Sandfrac treatment in the Fifth sand which reached 1,930-1,964 ft. It is the first well in the area to be so treated in this formation. Gas was encountered at 1,951-1,953 ft., and 1,956-1,961 ft. The initial flow of gas was 76,000 cu. ft. Four days after being treated, the gas increased to 625,000 cu. ft. It is expected to double this figure when the hole is entirely cleaned out.

Triadelphia district, Logan County, Columbian Carbon Co., 1-1191 Cole & Crane, was completed gaging 22,476,000 cu. ft. of gas natural, the largest initial open flow volume to be reported in several years. The gas was encountered in the Big lime at 2,848-2,854 ft., rock pressure 775 psi. in 2 hours, TD 2,857 ft.

OHIO

David Shafer et al. extended Layland pool ¾ mile to the north with a 90-bbl. well on 2 K. R. Uhl, Section 23, Killbuck Township, Holmes County. Clinton sand was found at 3,578-3,638 ft. and fractured.

WILDCAT COMPLETIONS

SOUTHWEST TEXAS

Aransas County: T. F. Muchison 1 Foster, David Lockhard Sur. 2. Dry. TD 7,806 ft.

Bandera County: Melvin L. Rossman et al 1 Goodenough, Gobbles Sur. 93.2 & 60. Dry. TD 5,509 ft.

Bell County: J. C. Jones 1 Howard, A., Manchacha Sur. Dry. TD 1,767 ft.

Brooks County: Forrest Oil Co. 1 Cage, Ireneo Lopez Sur. 654, A-380. Dry. TD 8,015 ft.

McMullen County: Alaska Steamship Co. and Newman Brothers Drilling Co. 9-A South Texas Syndicated, J. Fitzpatrick Sur. 20, A-670. Dry. TD 6,156 ft.

Nueces County: Kirkwood & Morgan, Inc., 1 Clara Driscoll est., Tract 2, George H. Paul "D" Subd. Dry. TD 7,355 ft.

Starr County: Garland Clymore and J. F. Whitehurst 1-D San Ramon, Las Sacatosa Grant. Dry. TD 2,810 ft.

Magnolia Petroleum Co. 4 Neblett, Lot E, Share 4, Subdivision B, El Benadito Grant. IP 107.11 BOPD, ⅜-in., 36.7°, casing perforations 5,901-05 ft. TD 9,000 ft. (New pay in El Benadito field.)

Corpus Christi Refining Co. 1 Trevino, Survey 193, A-216. IP 143.29 BOPD, 5/32-in., 46.2°, casing perforations 4,685-4,705 ft. TD 5,308 ft. (Extends Sun field.)

Starr Oil & Gas Co. 7 Caffarelli, Share 19-C, Porcion 80 and 81. Dry. TD 1,916 ft.

Webb County: A. G. Hill 1 Benavides, R. Benavides Sur. 714, A-2543. Dry. TD 3,365 ft.

W. Earl Rowe et al 1-A Moss, CCSD & RGNG Sur., Section 64. IP 6,000 M.c.f. daily, open flow, Queen City 4,088-91 ft. (casing perforations). TD 4,220 ft. (New field-North Tal Vez.)

Wilson County: Siznod Oil Corp. 1 Warren, P. Escamilla Sur. 34, A-99. Dry. TD 6,165 ft.

Zapata County: O. W. Killam 13 Bruni est., Block 48, Blas Uribe Grant. Dry. TD 4,320 ft.

Long Brothers 1 Cesereo, Block 63, Fansler Subd., Las Comita Grant. Dry. TD 3,205 ft.

TEXAS GULF COAST

Austin County: Hurt Oil Co. 1 Kunz est. et al, S. F. Austin Sur., A-7. Dry. TD 6,014 ft.

Bee County: Midstates Oil Corp. 1 Dahl, J. Cunningham Sur., A-141. IP 42 BOPD, 7/64-in., 42.2°, Slick sand 6,702-12 ft. (casing perforations). TD 7,305 ft. (Extends South Ceasar field.)

Brazoria County: E. Cockrell, Jr., et al 1 Bowers, J. Croce Sur., A-66. IP 107.95 BOPD, 7/64-in., 36°, casing perforations 5,568-88 ft. TD 6,574 ft. (New field.)

F. W. Gotcher et al 1 Pool, T.&W. Alley Sur. (Allen dome). Dry. TD 765 ft.

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WILDCAT COMPLETIONS

J. Ray McDermott & Co., Inc., 1 Berwick, HT & B Sur. 71, A-291. Dry. TD 5,250 ft.

Skelly Oil Co. 1-A Koutnik, Bogart & Taylor Subd. of W.D.C. Hall Lge., A-69. Dry. TD 9,304 ft.

Calhoun County: W. P. Clements, Jr., 1 State, Tract 33, San Antonio Bay. Dry. TD 9,030 ft.

H. L. Hunt 1 State, Tract 22-A, Lavaca Bay. Dry. TD 9,029 ft.

Fort Bend County: Cities Production Corp. 1 Horton, David Fitzgerald Sur., A-25. Dry. TD 8,250 ft.

Galveston County: James H. Snowden et al 1 Sealy-Smith Foundation. Dry. TD 7,367 ft.

Harris County: Edward D. Coulson 1 Weber, John Trobough Sur., A-59. Dry. TD 5,650 ft.

Harrell Oil Co. et al 1 Helberg, J. Reinerman Sur., A-649. IP 115.39 BOPD, 9/64-in., 38°, casing perforations 5,838-48 ft. TD 6,127 ft. (New field-Spring Creek.)

Harrell Oil Co. 1 Spears, Dan O'Neal Sur., A-617. Dry. TD 7,714 ft.

Lavaca County: H. R. Smith 1 VanDyke, Joseph McCrabb Sur., A-307. Dry. TD 7,350 ft.

Live Oak County: Houston Oil Co. of Texas et al 1 Skaggs et al unit 1, Block 84, C. F. Simmons Subd. IP, tubing completion, 3,425 M.c.f. daily with 29.7 BC per million cubic feet, open flow, casing perforations 6,948-56 ft. IP, casing completion, 6,000 M.c.f. daily with 23.6 BC per million cubic feet, open flow, casing perforations 6,455-65 ft. TD 7,930 ft. (New pay in Clayton field.)

Panel Oil Co. 1 House et al, John Hefferman Sur., A-11. IPP 4 BOPD, 21°, open hole 991-99 ft. TD 999 ft. (Extends Liska field.)

Matagorda County: Commercial Petroleum & Transport Co. 1 Huebner Unit 1, Peter Bertrand Sur., A-5. Dry. TD 9,407 ft.

Nelson Bunker Hunt trust 1 Burkhart, William Rabb Sur., A-78. Dry. TD 13,522 ft.

Skelly Oil Co. 2 Savage, Maria Cummins Sur. Dry. TD 8,520 ft.

San Jacinto County: Stanolind Oil & Gas Co. 1-B Carey, Francisco Mancha Sur., A-217. Dry. TD 10,379 ft.

Tyler County: R. I. Reid 1 Wheat & Reid, George Allen Lge., A-1. Dry. TD 3,496 ft.

Wharton County: J. B. Ferguson 6 Ferguson fee, Joshua Parker ½ Lge., A-49. Dry. TD 4,918 ft.

EAST TEXAS

Freestone County: R. W. Fair 1 Ella D. Cook, J. N. Acosta Sur., A-1. Dry. TD 4,611 ft.

Marion County: Grelling, Byars and Coulston 1 J. C. Murphy, N. M. Ricker Sur., A-327. IP 565 BOPD, ¾-in., 43°, Pettit pay 6,642-62 ft. TD 6,712 ft. Two miles north Woodlawn field.

Van Zandt County: E. B. Germany 1 Ethel Buchanan, William Page Sur., A-652. Dry. TD 5,910 ft.

WEST CENTRAL TEXAS

Brown County: R. L. and A. D. Carson 1 Jennie Stone Thomas, R. Mitchell Sur. 141. Dry. TD 1,233 ft.

J. J. Lynn 1 J. W. Moore, Sec. 16, Juan Delgado Sur. Dry. TD 3,251 ft., elev. 1,592 ft., Mississippian 3,245 ft.

Callahan County: J. K. Dobbs 1 A. McGraw, R. Henderson, Sur., A-852. Dry. TD 2,964 ft.

Coleman County: Beasley, Dood & Thomas 1 C. L. Eeds, Sec. 276, James West Sur. 276. IP 129 BOPD, 12/64-in., 41°, pay 1,560 ft. TD 1,572 ft.

Fason & Lee Co. 1 Harrell, Sec. 742, D. Frazier Sur. Dry. TD 802 ft.

Gilchrist Drilling Co. 2 Sealy & Smith, Sec. 43, GH&H. Dry. TD 3,411 ft.

Lee & Hughes 1 Sealy & Smith, 7-1-GH&H. Dry. TD 2,430 ft.

Guy Maybee Drilling Co. 1 Mrs. Mary I. Dunman, Sec. 118, W. G. Roddan Sur. Dry. TD 3,850 ft.

W. T. Waggoner Estate 2 Weathered, 69-2-GH&H. Dry. TD 3,351 ft.

Wm. J. Weaver 1-B Bozeman, 710-3-James H. Grimes Sur. IP 317 BOPD, 11/64-in., pay 2,432 ft. TD 2,644 ft.

Fisher County: Robert M. Bass 1 King, 183-1-BBB&C. Dry. TD 4,850 ft.

Haskell County: Allison & Prestridge 1 Simpson, G. B. Cook Sur. Dry. TD 5,882 ft.

Jones County: Frank Ausanka 1 T. B. Harrell, Sec. 3, OAL Sur. IPP 88 BOPD, 39°, Swastika sand 2,292 ft. TD 2,330 ft.

B. A. Duffy 1 Minor Alexander, 178-1-BBB&C. Dry. TD 6,370 ft.

Palo Pinto County: O. Redding 1 W. B. Mance, Robert Clark Sur. Dry. TD 1,829 ft.

Parker County: Humble Oil & Refining Co. 1 J. M. Doss, J. N. Gaines Sur. Dry. TD 5,897 ft.

Shackelford County: Gore Drilling Co. 1-A Kelly, 61-14-T&P. Dry. TD 2,010 ft.

Sojourner Drilling Co. 82-1 Windham, Blk. 13, T&P. IP 127 BOPD, 3/16-in., 40°, pay 3,890 ft. TD 3,909 ft.

Stephens County: E. B. Fletcher 1 A. L. Wagley, 27-7-T&P. IP 59 BOPD, 16/64-in., 41°, Lake sand 3,524-28 ft. TD 3,880 ft.

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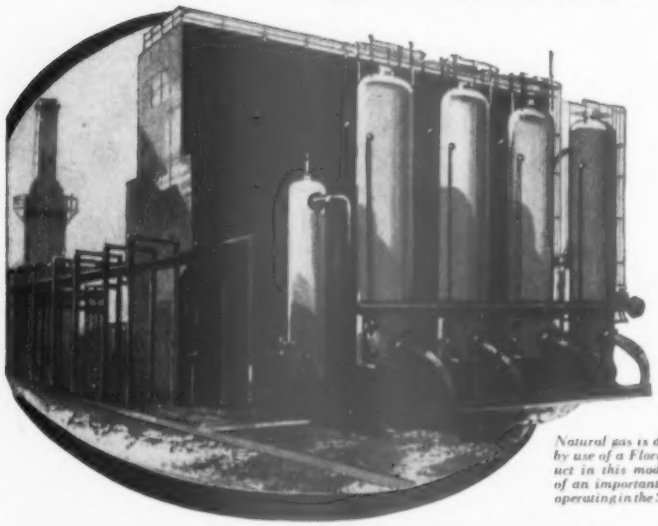

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WILDCAT COMPLETIONS

Stonewall County: Howsley, Jacobs & Swearinger 1 Gannaway, 301-2-H&TC. Dry. TD 5,949 ft.

Taylor County: Continental Oil Co. 1 Sam R. Cox Jr. 272-64-H&TC. Dry. TD 5,805 ft.

Sid Katz Exploration Co. 1 Russell, Lge. 148, Grimes CSL. Dry. TD 3,605 ft.

P. G. Lake, Inc. 1 L. N. Brown, Ramon Ortiz Sur. Dry. TD 2,325 ft.

Throckmorton County: A. A. Spears 3 Huston, Sec. 295, BBB&C Sur. Dry. TD 5,036 ft.

NORTH TEXAS

Archer County: C. U. Bay 1 K. A. Eschman, Blk. 3, Clark & Plumb. Dry. TD 4,147 ft.

C & D Oil Co. 4 E. E. Kunkell, Blk. 13, Wm. Ainsworth Sur. Dry. TD 1,285 ft.

Double E Drilling Co. 1 Abercrombie, Blk. 82, Harris Subd. Club Ranch. Dry. TD 1,419 ft.

J. Earle Gray 1 C. Threet, Blk. 105, Jefferson CSL. Dry. TD 1,146 ft.

R. A. King & Sons 3-A Perkins, Blk. 72, A-856, SPRR. Dry. TD 4,227 ft.

Y & B Drilling Co. 1 Aure Campbell, Blk. 2 A-815, SPRR. Dry. Dry. TD 1,394 ft.

Cooke County: Sam Harmon 1 Van Hill, W. C. Brown Sur., A-103. Dry. TD 2,160 ft.

Ralph Harper 1 W. S. Hutson, SPRR Sur., A-970. Dry. TD 2,602 ft.

Foard County: Round Top Oil Co. 1 Kincaid, 61-44-H&TC. Dry. TD 6,655 ft., elev. 1,576 ft., Strawn lime 5,340 ft., Ellenburger 6,630 ft.

The Texas Co. 1 Carroll, 15-A557-T&NO. Dry. TD 7,440 ft.

Grayson County: Howell, Holloway & Howell 3-A Hutchinson, Samuel Stueart Sur., A-1069. Dry. TD 4,011 ft.

Jack County: W. A. Lofton and W. R. Cooper 1 S. C. Cooper, A-737, TE&L Sur. 3314. Dry. TD 405 ft.

Russell Maguire 1 J. W. Damron, E. Robinson Sur., A-488. Dry. TD 5,811 ft., elev. 104 ft., Marble Falls 5,087 ft.

Wichita County: Ada Oil Co. 1 S. L. Denny, Sec. 27, Cowherd Subd. Dry. TD 4,805 ft.

Wilbarger County: Dublin-Kiel 1-G W. T. Waggoner, 48-3-H&TC. Dry. TD 2,003 ft.

Irvine Greenspan 2 Waggoner, 65-14-H&TC. Dry. TD 2,015 ft.

Frank Wood Associates, Inc. 1 Waggoner Estate "Young," 48-4-H&TC. Dry. TD 2,510 ft.

Young County: J. Earle Gray 1 Hightower, Blk. 190, TE&L. Dry. TD 1,270 ft.

Rocket Petroleum Co. 1 Leona Billingsley, A-827, TE&L Sur. 1104. IP 112 BOPD, 14/64-in., 40°, pay 2,722 ft. TD 2,746 ft.

Star Oil Co. 2 Hockaday Ranch, J. H. Haynes Sur., A-1870. IP 1,020 M.f.g., 20/64-in., gas pay 3,370 ft. TD 3,373 ft.

WEST TEXAS

Andrews County: Phillips Petroleum Co. 1 TT University, 41-5-University Lands. Dry. TD 13,995 ft., elev. 3,033 ft., Devonian 12,718 ft., Ellenburger 13,985 ft.

Cochran County: E. B. Fletcher 1 M. H. Davis, 18-U-PSL. Dry. TD 4,932 ft.

Crockett County: Continental Oil Co. 1-E Shannon, 15-BB-EL&RR. Dry. TD 9,931 ft., elev. 2,633 ft., Strawn 8,405 ft., Devonian 8,810 ft., Ellenburger 8,885 ft.

Shell Oil Co. 2 University 5, 27-5-University Lands. Dry. TD 11,377 ft., elev. 2,695 ft., Strawn 8,955 ft., Silurian 9,988 ft., Ellenburger 11,262 ft.

Culberson County: El Paso Natural Gas Co. 1 Montgomery-State, 17-100-PSL. Dry. TD 6,610 ft., elev. 4,506 ft., Pennsyl-

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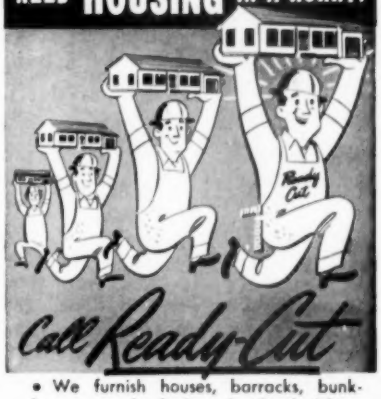

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WILDCAT COMPLETIONS

vanian 4,687 ft., Simpson 5,930 ft., Ellenburger 6,480 ft.

Dawson County: United States Smelting, Refining & Mining Co. 1 Sandidge, 110-M-EL&RR. Dry. TD 8,596 ft.

Garza County: W. A. Stockard 1 Ester Bird, 82-5-GH&H. Dry. TD 2,864 ft.

Hockley County: Sohio Petroleum Co. 1 Ellwood, 5-A-PSL. Dry. TD 11,619 ft., elev. 3,453 ft., Bend 10,602 ft., Ellenburger 11,476 ft.

Howard County: Falcon Oil Corp. 1 Lilly Pratt Brown, 22-34-T1N-T&P. IPP 10 BOPD, 25°, pay 3,178 ft. TD 3,302 ft.

Falcon 1 Doyle Vaughn, 12-34-T&P. IPP 7 BOPD, 25°, pay 3,195 ft. TD 3,291 ft.

Hudspeth County: Magnolia Petroleum Co. 1 State Lease 39881, 19-C University Lands. Dry. TD 5,420 ft.

Lamb County: San Juan Exploration Co. 1 F. E. Jones, 16-687-State Capitol Lands. Dry. TD 9,000 ft., elev. 3,465 ft., Wichita 6,960 ft., Wolfcamp 7,989 ft., granite wash 8,960 ft.

Mitchell County: Hal H. Simon 1 Cy Powell, 43-28-T&P. Dry. TD 3,520 ft.

Pecos County: Standard Oil Co. of Texas 1 Claude Owens 2, 25-178-TCRR. Dry. TD 9,672 ft., elev. 2,520 ft., Strawn 7,550 ft., Simpson 8,085 ft., Ellenburger 9,369 ft.

Schleicher County: C. E. Marsh 1 Willoughby, 11-2-GC&SF. Dry. TD 9,510 ft., elev. 2,319 ft., Strawn 8,265 ft., Ellenburger 8,325 ft., Wilburns 9,365 ft., Hickory 9,462 ft.

Sinclair Oil & Gas Co. 1 S. J. Hall, Sec. 5, Tom Green CSL. Dry. TD 6,416 ft., elev. 2,259 ft., Strawn 6,290 ft.

Scurry County: F. T. Brahaney 1 T. R. Martin, 665-97-H&TC. Dry. TD 3,130 ft.

Humble Oil & Refining Co. 1 Annie Jones, 487-97-H&TC. Dry. TD 8,370 ft., elev. 2,611 ft., Mississippian 8,154 ft., Ellenburger 8,280 ft.

SOUTHEAST NEW MEXICO

Eddy County: Don Anglo 1 State J, 7-19s-28e. Dry. TD 2,885 ft.

Richardson & Bass 1 Cobb-Federal, 23-20s-31e. IPP 215 BOPD, 35 bbl. water, 40°, Delaware pay 7,003 ft. Elev. 3,515 ft., Bone Springs 7,464 ft., Mississippian shale 13,390 ft., limestone 13,680 ft., Simpson 15,700 ft., Ellenburger 15,973 ft., pre-Cambrian granite 16,396 ft.

Lea County: Continental Oil Co. 4 Anderson Ranch, 11-16s-32e. IP 1,758 BOPD, ½-in., 42°, new pay at 9,669 ft. TD 9,914 ft.

Shell Oil Co. 1 Home State, 28-16s-37e. Dry. TD 12,125 ft., elev. 3,799 ft., Strawn 11,196 ft., Mississippian 11,922 ft.

ILLINOIS

Bond County: S. B. Griffith 1 Donk-Langel, SW NW NE 9-5n-4w. Dry. TD 2,201 ft.

Christian County: Walker Oil Co. 1 Heater, NE NE NW 15-14n-3w. Dry. TD 1,838 ft.

Clay County: Marion Partlow 1 Bonham, NE SW NE 14-3n-5e. Dry. TD 2,968 ft.

Crawford County: Atkins & Hale 1 Goodwin, NE SE SW 22-6n-11w. Dry. TD 1,065 ft.

Richland County: A. W. Cherry 1 Van Cleve, NW NE NE 26-3n-10e. Dry. TD 3,345 ft.

Wayne County: D. B. Lesh 1 Potter, SW NW SW 30-2s-8e. Dry. TD 3,479 ft.

INDIANA

Dubois County: Gus Poole 1 Miles, SW SW SE 27-3s-6w. Dry. TD 1,230 ft.

J. C. Jones 1 Spink, NW SE NW 16-3s-5w. Dry. TD 1,012 ft.

Gibson County: Davis Lambert 1 McConnell, NW NE SE 11-2s-10w. Dry. TD 1,970 ft.

Greene County: Lewis & Clemens 1 Holtsclaw, NW NW NE 23-7n-6w. Dry. TD 1,802 ft.

Frank Lyons 1 Swaby, SE SE SE 25-8n-7w. Dry. TD 1,770 ft.

Spencer County: W. H. Winfrey 1 Huebschman, W½ SE SW 36-5s-4w. Dry. TD 998 ft.

Sullivan County: Shulman Bros. 1 Bostick, NW NW NE 17-9n-9w. Dry. TD 2,284 ft.

KENTUCKY

Daviess County: H. C. Farmer 1 (2) Lashbrook, SW SW SW 13-O-30. Dry. TD 1,454 ft.

F. H. Rhoades 1 (2) Wilhoite, SE SE NW 17-Q-31. Dry. TD 1,140 ft.

Christian County: Ryan Oil Co. 3 Fowler, NE SW NW 20-H-22. Dry. TD 1,594 ft.

Henderson County: Eakle & Holder 1 Toy, NE SW SW 4-O-24. Dry. TD 2,600 ft.

Hopkins County: Delta Drilling Co. 1 Jackson, SE NW NE 20-M-25. Dry. TD 3,174 ft.

MICHIGAN

Allegan County: Cook Drilling Co. B-4 U.S.A., NE NW NW 28-2n-14w. Dry. TD 1,336 ft. in Traverse.

Arenac County: J. O. Mutch 1 White, SW SE NE 25-19n-3e. Dry. TD 2,167 ft. in Traverse.

C. W. Collin 1 Templin, NE NE NW 15-20n-3e. Dry. TD 3,010 ft. in Dundee.

Jack Uhl 1 McFarlan, NE NW SW 34-20n-3e. IP 35 BOPD. Dundee 2,911 ft. Pay 2,984-88 ft., TD 2,988 ft. (New pool.)

Charlevoix County: The Pure Oil Co. 1 Jaremia, SE SE NW 1-32-5w. Dry. TD 1,159 ft. in Dundee.

"Vacuum tanks do jobs that no other tool can do!" says Jack Bryan, trucking operator.

JACK BRYAN, shown here taking delivery of two new units, is one of the many truck operators who started with a small Thompson Unitized Vacuum tank. He now has a fleet of four 80-bbl. units in addition to many smaller Thompson UVT combinations.

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Tank & Manufacturing Co., Inc.
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WILDCAT COMPLETIONS

Hillsdale County: The Pure Oil Co. 1 Schmitt, SW NE NE 3-7s-3w. Dry. TD 1,400 ft. in Dundee.

Kent County: Clarence N. Crawford 1 Gillson, NE NE SE 32-9n-12w. Dry. TD 5,055 ft. in Niagaran.

Mason County: Augie Busk & Carl Grimes 1 Pagano, SW SW NE 2-20n-17w. Dry. TD 1,915 ft. in Dundee.

Mecosta County: Smith Petroleum Co. 1 Bender, NE SW SW 20-16n-10w. Dry. TD 3,002 ft. in Traverse.

Montcalm County: W. B. Darke 1 Loree, SE NE NE 13-9n-6w. Dry. TD 3,147 ft. in Dundee.

Ottawa County: Thomas F. Herzog 1 Allen et al, SE SW SW 29-8n-13w. Dry. TD 1,937 ft. in Traverse.

St. Clair County: Sun Oil Co. 1 Schafter, NW SE NE 28-5n-16e. Dry. TD 2,954 ft. in Niargaran.

OHIO

Knox County: H. E. Perkins 1 Frank Hall, 2nd Qr., Pleasant Township. Dry. TD 4,617 ft. in sub-Trenton.

MARYLAND

Garrett County: Eberly & Snee 1 H. Swartzengruber, 1,300,000 cu. ft. gas, after shot, rock pressure 1,200 psi. in 4 hours, Chert 3,228 ft., gas 3,245-3,248 ft., TD 3,379 ft.

Cumberland & Allegheny Gas Co. 1 Swartzengruber, 30,000 cu. ft., gas after acidizing, rock pressure, 1,025 psi. in 72 hours, Onondaga 3,889 ft., Chert 3,918 ft., gas 3,950-3,964 ft., Oriskany sand 4,067 ft., TD 4,037 ft.

FLORIDA

Bay County: A. R. Temple 1 Gregg, C SW SW 14-3s-13w. Dry. TD 5,009 ft. Elev. 58 ft., Chalk 3,119 ft., lower Tuscaloosa 4,818 ft., Massive 4,903 ft.

ALABAMA

Conecuh County: Lyle Cashion Co. 1 W. K. Horton, Jr., C SW SW 22-5n-11e. Dry. TD 4,810 ft.

MISSISSIPPI

Forest County: Southern Natural Gas Co. 1 Creosote, NW NE NE 10-1s-13w. IP 771 M.c.f. daily, 12/64-in., Tuscaloosa 7,286-7,314 ft. TD 8,667 ft. Elev. 313 ft., Wilcox 2,848 ft., Chalk 6,061 ft., upper Tuscaloosa 7,277 ft., marine Tuscaloosa 7,892 ft., Massive 8,594 ft. (New field.)

George County: Crow Drilling Co. 1 Green, 3-2s-8w. Dry. TD 8,237 ft. Elev. 97 ft., Chalk 5,492 ft., Eutaw 6,768 ft., Tuscaloosa 7,390 ft., Massive 8,075 ft.

Jefferson County: Petersen Drilling Co. 1-A Groome, 31-8n-2e. Dry. TD 6,511 ft. Elev. 483 ft., Sparta 2,850 ft., Wilcox 4,152 ft., base Big shale 5,582 ft., Artman sand 5,920 ft.

Jones County: Gulf Refining Co. 1 Bailey, NE SW SE 27-10n-13w. IP 195 BOPD, 7/64-in., 43.7°, Glenn Rose 11,966-74 ft. and 11,987-990 ft. (casing perforations). TD 12,369 ft. Elev. 295 ft., Chalk 5,053 ft., marine Tuscaloosa 7,514 ft., lower Tuscaloosa 7,669 ft., Massive 7,873 ft., lower Cretaceous 8,290 ft., Ferry Lake anhydrite 11,162 ft. (New pay in Soso field.)

Kemper County: Harvey J. Weir & Son 1 Fleming est., C NE SW 17-10n-18e. Dry. TD 3,829 ft. Elev. 246 ft., Eutaw 1,077 ft., Tuscaloosa 1,512 ft., lower Tuscaloosa 2,152 ft., Massive 2,295 ft.

Wilkinson County: Gulf Refining Co. 30 Crosby, 20-4n-2w. IP 92 BOPD, ¾-in., 35.5°, Wilcox 5,091-93 ft. (casing perforations 5,091-93 ft. TD 7,196 ft. (New field—South Possum Corner.)

SOUTH LOUISIANA

Cameron Parish: The Texas Co. and A. C. Glassell, Jr., 3 Comegys et al, 7-13s-3w. IP 5,380 M.c.f. daily, 20/64-in., casing perforations 6,058-76 ft. TD 6,386 ft. (New pay in Grand Lake field.)

Magnolia Petroleum Co. 4 Abel West heirs, 3-15s-10w. Dry. TD 11,600 ft.

Iberville Parish: The Texas Co. 1 Wilbert Unit 1, 31-8s-10e. Dry. TD 10,500 ft.

Plaquemines Parish: California Co. 7 State Lease 1786. Dry. TD 12,005 ft.

St. Charles Parish: W. T. Burton 9 Simoneaux, 12-15s-20e. IP 150 BCPD and 370 M.c.f. daily, 12/64-in., 51°, casing perforations 12,000-022 ft. TD 14,120 ft. (New pay in Des Allemands field.)

St. Landry Parish: Continental Oil Co. 1 Vidrine, 53-5s-3e. Dry. TD 11,300 ft.

St. Mary Parish: Fifteen Oil Co. 21 South Coast, 30-13s-10e. IP 315 BOPD, 8/64-in., 27°, casing perforations 10,938-40 ft. TD 11,050 ft.

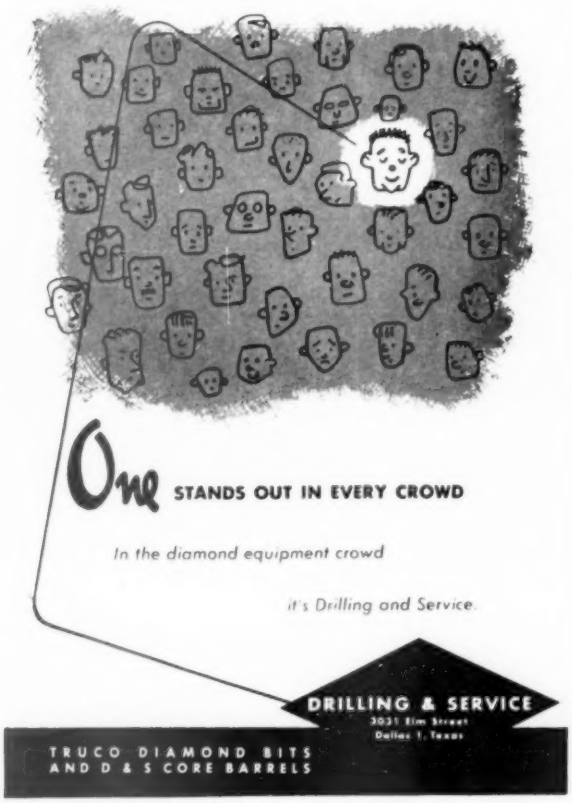
Terrebonne Parish: Magnolia Petroleum Co. 4-B State Lease 766, Block 87 (surface location), Ship Shoal area (bottom location in Block 76). IP 568 BOPD, 12/64-in., 38°, casing perforations 9,786-94 ft. TD 12,261 ft. (New pay in Ship Shoal Block 72 field.)

NORTH LOUISIANA

Bossier Parish: Gulf Refining Co. 2 Johnson Est., 657 ft. N and 964 ft. W Sec. 7-21n-13w. Dry. TD 2,300 ft.

Claiborne Parish: Carter Oil Co. 1 Caldwell, 510 ft. N and 650 ft. W SEc. NE SW 20-19n-7w. Dry. TD 11,396 ft.

Concordia Parish: Billups Bros.-Vasser & Brown 1 Krauss, 1,932 ft. S and 696 ft. W NEc 6-7n-8e. Dry. TD 6,500 ft.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THE OIL AND GAS JOURNAL

"I thought you said you could back that thing!"

WILDCAT COMPLETIONS

Carter Oil Co. 2 James, 26-4n-9e. IPF BOPD, Wilcox 6,747-50 ft. 10/64-in., 47.2°, TD 7,512 ft. (Opens Roseland pool.)

Ouachita Parish: W. C. Feazel et al 1 Wininger, 1,573 ft. S and 2,970 ft. E of NWc 11-18n-1e. IP 2,854 M.c.f. gas per day, Bodcaw 9,048-49, 9,054-64 ft. TD 9,621 ft. (Opens Carlton field.)

Tensas Parish: Heep Oil Corp. 1 Magnolia-Learned, 12-10n-12e. IPF 166 BOPD, Tuscaloosa Massive 9,254-62 ft., 32/64-in., 39.6°, TD 9,288 ft. (Opens Rodney Island.)

Union Parish: Southwest Gas Producing Co. et al 1 Hicks, C SW¼ 28-21n-2w. Dry. TD 8,438 ft.

ARKANSAS

White County: W. M. Parks et al 1 Gregg, 4-6n-5w. Dry. TD 931 ft.

OKLAHOMA

Beaver County: Aladdin-Argo 1 Peltor, SW NE SE 17-6n-20eCM. Dry. TD 6,525 ft.

Cimarron County: Colorado-Interstate 1 Wiggins "B," NE NE SW 26-4n-8eCM. IP 40,000 M.c.f. gas daily, Keyes sand 4,703-27 ft. TD 4,800 ft.

Colorado-Interstate 1 Rhoton, NE NE SW 27-4n-8eCM. IP 43,000 M.c.f. of gas daily, Keyes sand 4,742-80 ft. TD 4,805 ft.

Colorado-Interstate 1 Stallard, SW SW NE 9-5n-8eCM. IP 16,100 M.c.f. gas daily, Keyes sand 4,704-18 ft. TD 4,808 ft.

Coal County: Delhi Oil 1 Moudy, SE NE SE 10-2n-11e. Dry. TD 12,071 ft.

Cotton County: S. E. Hutcheson 1 Ferrel Harvey, NW NW NE NE 12-2s-14w. Dry. TD 1,605 ft.

Hughes County: Ashland Oil & Refining Co. 1 Rogers, SW SE SW 14-9n-8e. Dry. TD 4,394 ft.

Jefferson County: Mack Oil Co. 1 Ollen, SW SW NE 4-6s-6w. Dry. TD 3,337 ft.

Kay County: Graham, Messman & Rinehart Drilling Co. 1 Vanhoozer, NE NE SE 14-28n-1e. Dry. TD 3,776 ft.

LeFlore County: Athletic Mining & Smelter Co. 1 Dunn, SW NE SW 35-9n-24e. Dry. TD 6,292 ft. Lower Simpson 6,108 ft.

Lincoln County: W. H. Elson 1 State, NE NE NW 16-12n-4e. Dry. TD 5,460 ft.

Geo. Pasquella and McBride 1 Vanderpool, SW SW NW 28-13n-6e. Dry. TD 4,457 ft.

Logan County: The Texas Co. 1 Brown, SW NE SW 35-15n-3w. Dry. TD 6,490 ft.

McClain County: Jay Simmons et al 1 Johnson, C SW SW 13-8n-4w. IPF 80 BOPD, Hart sand 8,698-8,764 ft. TD 9,530 ft. (New pay at North Freeny.)

Murray County: Barton & Rich 1 Crawford, S½ S½ NW SE 36-2n-3e. Dry. TD 953 ft.

Noble County: Helmerich & Payne 1 Dolezal, NW NW SE 11-20n-1w. Dry. TD 5,005 ft.

Gardner Petroleum and D&E Oil Co. 1 Elliott, NE SW NW 14-21n-1w. Dry. TD 3,737 ft.

Okfuskee County: Geo. Puckett and Arthur Finston 1 Parsons, NW NW SE 6-12n-8e. Dry. TD 3,815 ft.

Russell Cobb, Jr. 1 Jones, SW SW SE 1-12n-9e. Dry. TD 3,203 ft.

Osage County: Kewanee Oil Co. 1 Osage, SE NE NW 13-26n-6e. Dry. TD 2,948 ft.

Pittsburgh County: Carter Oil Co. 1 Pratt, SW SW SE 30-9n-17e. Dry. TD 5,748 ft.

KANSAS

Barton County: Ash-Mar 1 Kent, NW NW NW 13-18s-13w. Dry. TD 3,485 ft.

Coffey County: W. E. Ellis 1 Beyer, SW NW NE 24-22s-13e. Dry. TD 2,262 ft.

Ellis County: Champlin Refining Co. 1 Never, NE NE SW 6-11s-16w. Dry. TD 3,555 ft.

Braden Drilling Co.-J. M. VanZandt 1 Leimmiller, NW NW NW 2-12s-19w. Dry. TD 3,816 ft.

Bennett & Roberts 1 Kraus, NE NE NE 29-13s-18w. Dry. TD 3,780 ft.

Pam-Kar 1 Stadelman, SW SW SW 2-14s-19w. Dry. TD 3,925 ft.

Bay Petroleum 1 Degenhart, NW NW SW 15-15s-17w. IPP 126 BOPD, Lansing-Kansas City 3,417-25 ft. TD 3,559 ft. (Opens Dagenhart pool.)

Ellsworth County: Musgrove Petroleum 1 Splitter, NE NE NW 21-17s-9w. Dry. TD 3,310 ft.

Graham County: Jones, Shelburne & Farmer 1 Lewis, NE NE SE 16-10s-21w. Dry. TD 3,864 ft.

Walters Drilling Co. 1 Griffith, NE NE NE 26-10s-22w. Dry. TD 3,951 ft.

Greenwood County: McGinnis 1 Short, C SE NW 10-24s-11e. Dry. TD 2,045 ft.

W. McGinnis et al 1 Redding, NE NW NW 11-24s-11e. Dry. TD 1,874 ft.

Isenhour 1 Short, SW SW SW 15-24s-11e. Dry. TD 2,082 ft.

Harper County: Superior 1 Balmer, NW NW NW 15-32s-6w. Dry. TD 4,922 ft.

Kearney County: Trans-Era-N. Appleman 1 Miller "C," NE NE NE 23-22s-37w. Dry. TD 5,180 ft.

Kingman County: Cities Service Oil Co. 1 Fluke "B," SE SE NW 10-27s-9w. Dry. TD 4,458 ft.

McPherson County: D. I. Ingling et al 1 Vahsholtz, SW SW NE 15-19s-1w. Dry. TD 2,942 ft.

E. K. Carey 1 Friesen, NE NE SE 36-21s-5w. Dry. TD 4,052 ft.

Morton County: J. M. Huber Corp. 1 Lemon, SW SW NE 31-32s-40w. IP 2,200 M.c.f. gas daily, Hugoton pay. TD 5,605 ft.

Cities Service 1 Roll "A," SE SE NW 28-34s-43w. IP 31,400 M.c.f. gas daily, Topeka 2,712-2,852 ft. TD 3,090 ft. (Discovery Greenwood South.)

Pawnee County: Cities Service 1 Davison, SE SE NE 23-21s-17w. Dry. TD 3,952 ft.

Vickers Exploration, Ltd., 1 Bowman, NW SW SW 32-22s-15w. Dry. TD 4,017 ft.

Phillips County: Hanson-C&G 1 Baldwin, NW NW NW 26-4s-20w. Dry. TD 3,530 ft.

Pratt County: K&E 1 Gobin, SE SE NW 34-25s-13w. Dry. TD 4,397 ft.

GMR 1 McGuire, SW NW SW 24-27s-13w. Dry. TD 4,455 ft.

Rush County: Shelley-Miller Drilling Co. 1 Werth, NE NE NE 1-16s-19w. Dry. TD 3,610 ft.

Saline County: Republic Natural Gas Co. 1 Hawkinson, SE SE SE 25-16s-5w. Dry. TD 3,966 ft.

Sheridan County: Don Pratt 1 Cooper, SW SW SE 25-8s-29w. Dry. TD 4,640 ft.

Trego County: Deep Rock Oil Co. 1 Kastner SE SE NW 6-14s-21w. Dry. TD 4,133 ft.

Deep Rock 1 Moore, SW SE NW 1-15s-21w. Dry. TD 3,902 ft.

NEBRASKA

Gosper County: Shell Oil Co. 1 Madison, C NE NE 33-7n-23w. Dry. TD 3,139 ft. Pre-Cambrian 3,130 ft.

Kimball County: Western Central Petroleum-Mitchell Oil Co. and Derby Oil Co. 1 Johnson, NW NE NW 35-16n-54w. Dry. TD 5,880 ft.

Harry Royster 1 Barrett, NW SW SW 7-16n-56w. Dry. TD 6,800 ft. Temp. abd.

Red Willow County: Sauvage Drilling Co. 1 Anderson, SW SW SE 14-4n-28w. Dry. TD 3,610 ft. Topeka 3,048 ft.

Valley County: Shell Oil Co. 1 Valla, NW NW NE 6-19n-16w. Dry. TD 3,175 ft. Marmaton 3,094 ft.

SOUTH DAKOTA

Harding County: Gallup, Carter Oil Co. 1-A Chas. W. Hendricks, SW NW 2-20n-3e. Dry. TD 9,052 ft. Winnipeg 8,978 ft.

NORTH DAKOTA

Divide County: Argyle 1 Noonan, C SW NE 11-162n-95w. Dry. TD 6,957 ft. Mission Canyon 6,768 ft.

McHenry County: Calvert Exploration and Don Traders, Inc. 1 Bachmeier, C NW SW 23-154n-76w. Dry. TD 3,968 ft. Lodgepole 3,748 ft.

Wells County: E. Wilson Germany-Cardinal Drilling Co. 1 Faul, C SE NW 13-148n-73w. Dry. TD 3,498 ft. Lodgepole 3,295 ft.

CALIFORNIA

Fresno County: D. H. Graham, Opr. 1 Morris, 19-15s-18e. Dry. TD 5,357 ft.

Glenn County: Sunray Oil Corp. 1 Cushman, NW SE 18-19n-1w, IP 3,310 M.c.f. per day, 20/64-in. choke, perforation 4,485-4,574 ft., TD 5,000 ft. (1 mile northeast extension to Beehive Bend field).

Kern County: Dariele Amfitheatrof et al 1 Barnes, 25-32s-31e. Dry. TD 992 ft.

Ferguson & Bosworth 3 Porter Community, 19-29-21e. Dry. TD 817 ft.

D. D. Feldman Oil & Gas Co. 1-A General American, 30-31s-24e. Dry. TD 4,070 ft.

Honolulu Oil Corp. 1 Honolulu-Watson-C.C.M.O., NW SW 15-30s-21e, IPF 229 PBD, cut 3 per cent, 37.2° gravity, 19/64-in. choke perforations 2,852-67 ft., TD 4,952 ft. (New Phacoides sand pool in Northwest Belgian Anticline field.)

Monterey Oil Co. 45 Indian Oil Co., 7-32s-25e. Dry. TD 6,025 ft.

Moriqui Exploration Co. 5 Anderson, 15-30s-21e. Dry. TD 3,850 ft.

*Standard Oil Co. of California 42-K.C.L.-33, SW NE 28-11n-20w, IPF 251 BOPD, 31° gravity, ½-in. choke, perforations 3,980-4,046 ft., TD 4,151 ft. (New Olcese pool discovery in Wheeler Ridge field.)

Los Angeles County: The Texas Co. 1 K. Shimizu, 15-2s-12w. Dry. TD 9,206 ft.

Orange County: Superior Oil Co. 4 Guarantee, 33-3s-9w, IPP 485 BPD, cut 3.6 per cent, 19° gravity, perforations 4,571-4,964 ft., TD 4,982 ft. (Approx. ¼ mile south extension to Richfield-Atwood pool.)

San Joaquin County: Terry & Jansen 1 Mildred Island, 34-2n-4e. Dry. TD 6,000 ft.

Ventura County: Union Oil Co. 19 Simi, 16-3n-17w. Dry. TD 6,734 ft.

MONTANA

Roosevelt County, East Poplar area: Empire State Oil Co. 1 Smith "C," S½ SW SE 8-29n-51e. IPF 3,648 BOPD, B-2 zone 5,770-78 ft. Charles 5,512 ft. TD 5,977 ft. (Charles discovery, new field, shut in for storage.)

WYOMING

Big Horn County, Hyattville area: Superior Oil Co. 1 Mercer, NE NE NE 2-49n-90w. Dry. TD 1,734 ft. Water well.

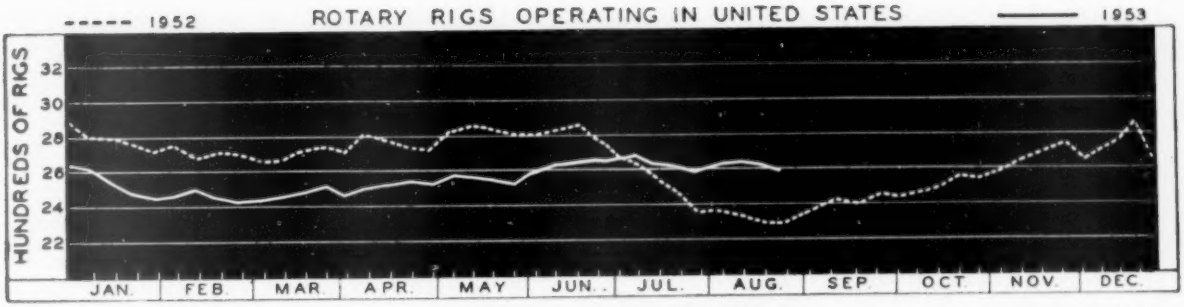
Fremont County: Happy Springs area: True & Brown 1 Fremont Sheep, SE SW SE 6-28n-93w. Dry. TD 5,115 ft. Frontier 4,430 ft.

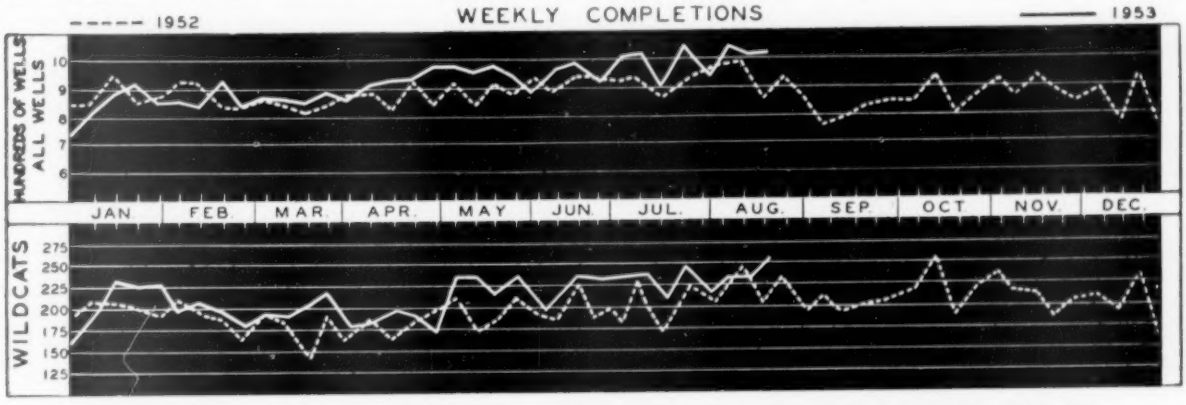
North Happy Springs: J. K. Wadley 1 Government, SW SW SE 34-20n-93w. Dry. TD 3,153 ft.

Natrona County: Amerada Petroleum Corp. 1 Government-Brannan, SW NW NE 29-33n-78w. Dry. TD 6,980 ft. Tensleep 6,865 ft.

Park County, North Shoshone area: V. A.

(Continued on page 187)





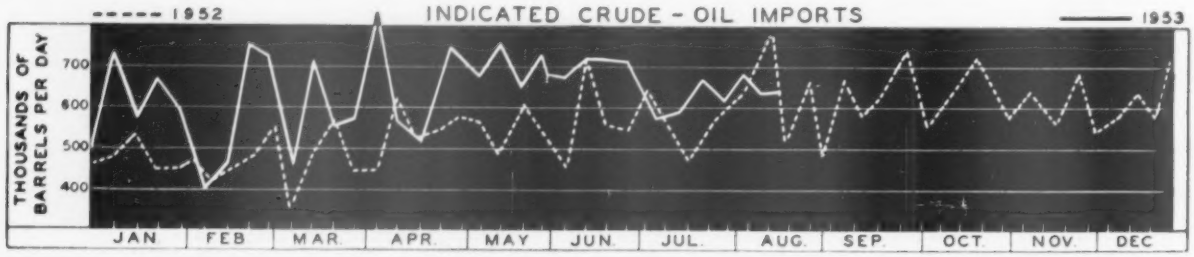
CURRENT STATISTICS

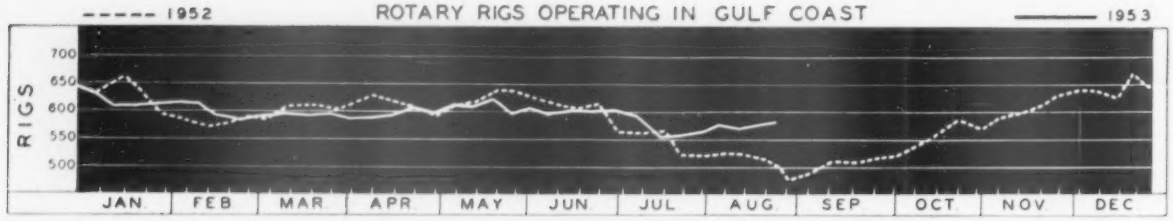
EXPLORATION

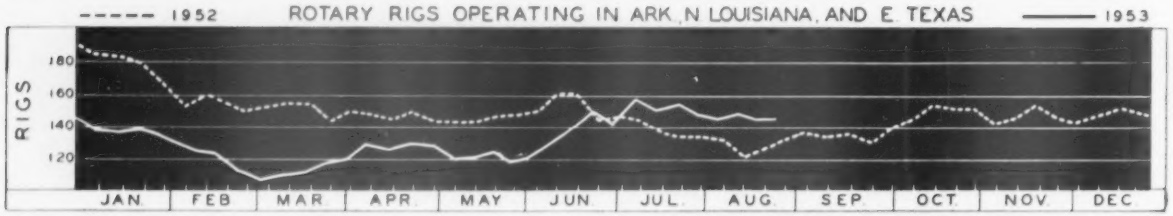
WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 22, 1953

	Total of all wells					Aug. 22		Wildcat completions and discoveries					Cumulative total, 1953				
	Comp.	Oil	Gas	Dry	Footage	1953	1952	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	18	9	0	*9	26,375	466	511	0	0	0	0	0	0	0	0	0	0
Pennsylvania	47	21	5	†21	86,200	1,153	1,243	0	0	0	0	0	0	0	3	11	14
West Virginia	13	2	9	2	26,358	395	381	0	0	0	0	0	0	0	6	3	9
Ohio	31	17	3	‡11	64,150	667	668	0	0	0	1	1	2	0	1	12	15
Indiana	25	8	0	17	40,043	820	802	0	0	0	7	7	11	0	2	217	230
Kentucky	25	8	0	17	40,853	696	824	0	0	0	6	6	6	0	1	119	126
Illinois	31	11	1	19	80,299	1,189	1,270	0	0	0	6	6	4	0	0	262	266
Michigan	16	5	0	11	36,938	379	454	1	0	0	11	12	11	0	5	159	175
Kansas	98	43	9	§46	337,203	3,135	3,041	1	0	2	27	30	70	0	27	490	587
Nebraska	11	4	0	7	52,289	216	169	0	0	0	5	5	14	0	3	92	109
Oklahoma	159	90	12	§57	563,008	4,668	3,748	1	0	3	17	21	77	6	25	412	520
Texas	328	180	22	126	1,527,907	11,064	11,707	15	1	2	84	102	575	41	130	2,709	3,455
North Central (Dist. 7-B & 9)	123	70	2	51	395,408	4,161	3,772	6	0	1	37	44	299	0	14	1,107	1,420
West (Dist. 7-C & 8)	73	52	0	21	400,070	2,380	3,643	2	0	0	16	18	114	2	10	428	554
Panhandle (Dist. 10)	18	11	4	3	56,641	515	446	0	0	0	0	0	0	2	0	15	17
Eastern (Dist. 5 & 6)	14	7	2	5	78,843	516	546	1	0	0	2	3	14	2	4	174	194
Gulf Coast (Dist. 2 & 3)	45	15	3	27	304,425	1,642	1,725	4	1	0	17	22	78	16	54	429	577
Southwest (Dist. 1 & 4)	55	25	11	19	292,520	1,850	1,575	2	0	1	12	15	70	19	48	556	693
Louisiana	56	24	4	28	421,970	1,655	1,486	3	2	1	9	15	51	25	16	225	317
Northern	24	10	2	12	105,332	666	788	2	1	0	4	7	7	2	2	81	92
Southern	32	14	2	16	316,638	989	698	1	1	1	5	8	44	23	14	144	225
Arkansas	12	9	0	3	43,393	316	245	0	0	0	1	1	10	0	0	71	81
Mississippi	12	6	2	4	89,519	238	236	2	0	1	3	6	12	1	4	113	130
Southeastern States	3	0	0	3	15,955	93	43	0	0	0	2	2	1	0	0	74	75
Montana	6	4	0	2	31,386	248	177	1	0	0	0	1	8	0	0	65	73
Wyoming	20	12	0	8	111,879	436	428	1	0	0	6	7	15	0	0	80	95
Colorado	17	6	2	9	90,854	419	278	1	0	0	7	8	19	0	9	188	216
Utah	1	0	0	1	1,480	47	46	0	0	0	1	1	2	0	4	26	32
New Mexico	33	16	13	4	192,940	870	682	2	0	0	2	4	13	0	7	78	98
California	47	32	4	11	209,753	1,627	1,566	3	0	1	9	13	40	0	7	360	407
North Dakota	7	3	0	4	48,083	166	46	0	0	0	3	3	7	0	0	37	44
Miscellaneous (Md., S. D., Idaho)	4	0	2	2	16,926	41	81	0	0	2	2	4	1	0	3	31	35
Total United States	1,020	510	88	422	4,155,761	31,004	30,132	31	3	12	209	255	949	73	253	5,834	7,109
Total previous week	1,011	529	72	410	4,148,757			43	1	7	182	233	918	70	241	5,625	6,854
Total August 23, 1952	934	469	67	398	3,828,260			39	4	5	180	228	921	58	161	5,434	6,574

Service wells included: *9, †18, ‡2, §1.



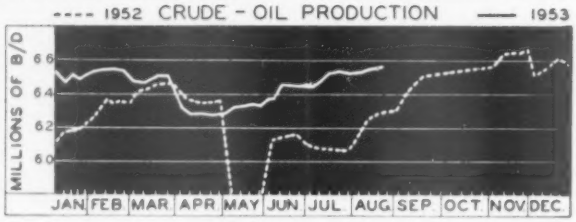


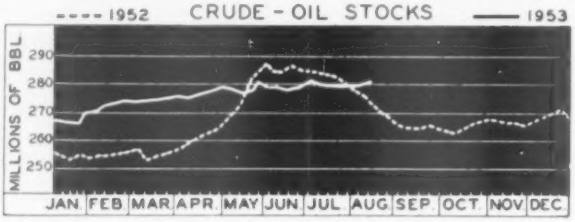


DAILY AVERAGE PRODUCTION FOR WEEK

	August 22			Aug. 15
	Crude oil	Lease condensate	Total	total
Alabama	5,[illegible]		5,000	5,100
Arkansas	77,650	450	78,100	78,000
California	1,008,400		1,008,400	1,010,100
Colorado	107,700		107,700	108,900
Eastern	59,200		59,200	59,200
Florida	1,550		1,550	1,550
Illinois	163,600		163,600	161,100
Indiana	34,700		34,700	35,600
Kansas	340,200		340,200	320,300
Kentucky	30,800		30,800	31,300
Louisiana	663,775	32,900	696,675	696,275
North	107,600	2,900	110,500	110,100
South	556,175	30,000	586,175	586,175
Michigan	30,700		30,700	32,500
Mississippi	93,000	3,200	96,200	96,800
Montana	31,400		31,400	31,800
Nebraska	17,900		17,900	17,200
New Mexico	199,200	750	199,950	199,950
Oklahoma	557,500		557,500	552,200
Texas	2,840,725	43,850	2,884,575	2,884,575
Dist. 1	39,675	350	40,025	40,025
Dist. 2	157,475	5,700	163,175	163,175
Dist. 3	454,100	22,000	476,100	476,100
Dist. 4	270,900	5,800	276,700	276,700
Dist. 5	49,750	350	50,100	50,100
Dist. 6	128,700	4,900	133,600	133,600
East Texas field	246,600		246,600	246,600
Dist. 7-B	120,625	50	120,675	120,675
Dist. 7-C	173,350	3,800	177,150	177,150
Dist. 8	934,275	500	934,775	934,775
Dist. 9	188,775	350	189,125	189,125
Dist. 10	76,500	50	76,550	76,550
Utah	5,800		5,800	5,900
Wyoming	211,600		211,600	212,000
North Dakota	14,300		14,300	14,000
Total U. S.	6,494,700	81,150	6,575,850	6,554,350
Change from previous week			up 21,500	
Total U.S. production January 1-August 22			1,509,334,300 bbl.	
Same period last year (crude plus cond.)			*1,438,150,250 bbl.	

*Includes 20,573,385 bbl. condensate.



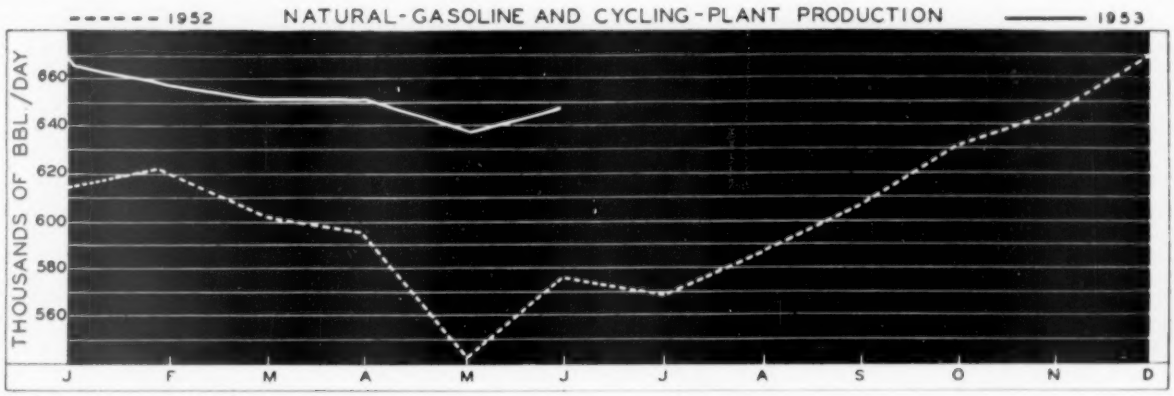


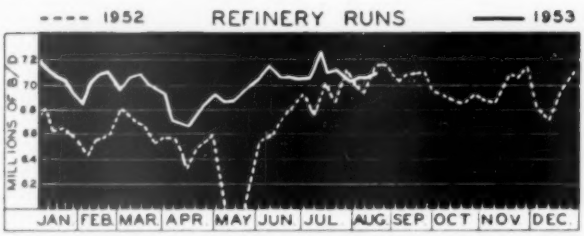
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

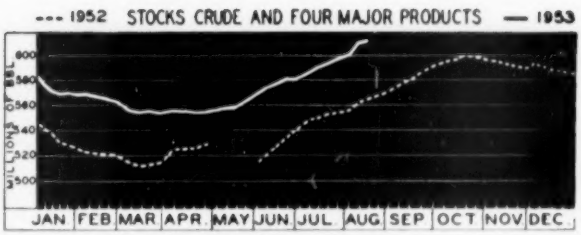
(Thousands of barrels)

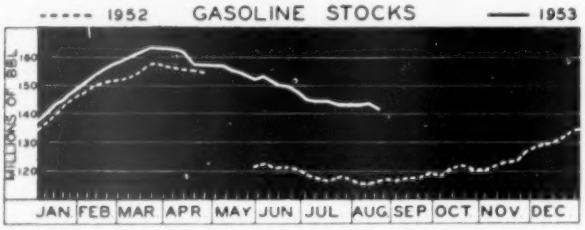
	Aug. 15, '53	Aug. 8, '53	Aug. 16, '52
Pennsylvania Grade	2,715	2,677	2,406
Other Appalachian	2,253	2,230	2,044
Illinois, Indiana, Michigan	12,261	12,382	12,843
Arkansas	2,934	2,984	3,147
Louisiana	16,711	16,296	15,536
North	2,884	2,827	2,338
Gulf	13,827	13,469	13,198
Mississippi	3,515	3,412	3,761
New Mexico	8,165	7,667	7,489
Oklahoma and Kansas	39,479	38,660	40,329
Texas	132,100	132,872	129,700
East Texas	11,149	11,050	12,937
West Texas	58,681	59,422	57,056
Texas Gulf	28,052	27,779	28,010
Other Texas	34,218	34,621	31,697
Rocky Mountain	16,997	16,985	14,277
California	33,031	33,284	30,673
Foreign	†9,984	10,162	8,361
Total	280,145	279,611	270,566

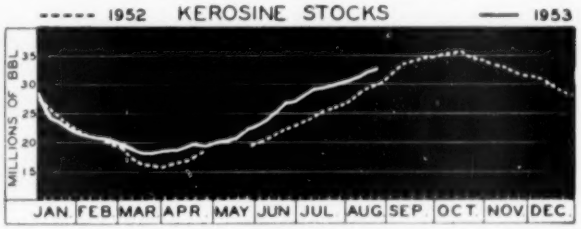
*Bureau of Mines. †Includes 2,577,000 bbl. in California.

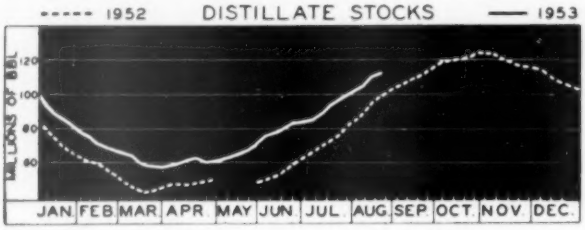


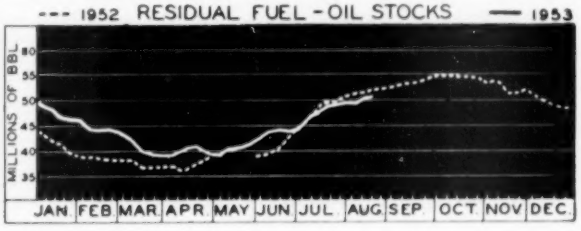










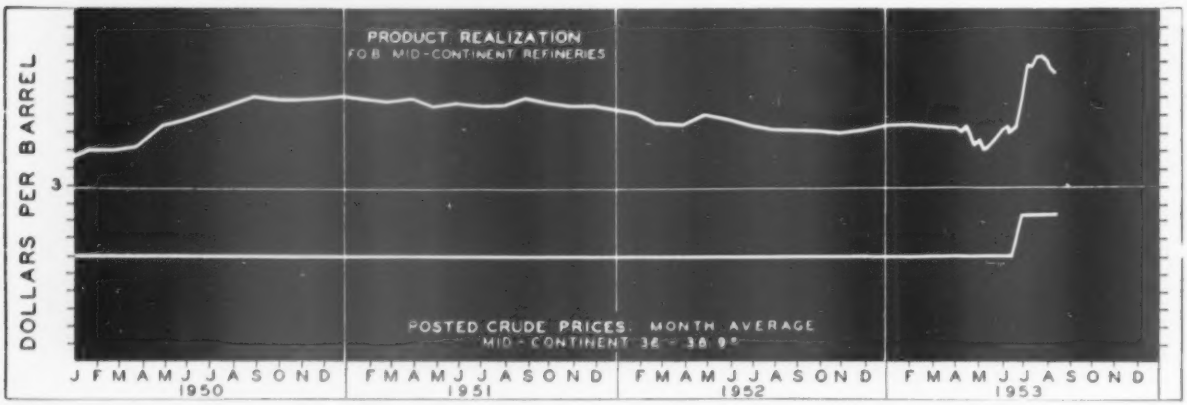


A.P.I. REFINERY REPORT, AUGUST 22

(Thousands of barrels)

District—	Daily avg. runs	Daily average production — Gaso.*	Kero.	Dist.	Resid.	Stocks‡ — Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, August 1952 — Daily avg. runs	Daily average production — Gaso.*	Kero.	Dist.	Resid.
East Coast	1,029	422.6	36.6	248.7	222.6	33,231	13,567	29,482	13,024	1,062	428.9	48.0	239.5	225.2
Appalachian:														
District 1	93	45.6	5.6	18.3	11.1	3,438	613	1,295	746	105	42.3	5.0	14.0	9.3
District 2	89	51.0	7.4	8.9	10.9	1,577	504	533	142	76	41.7	1.7	15.4	14.2
Ind., Ill., Ky	1,340	735.0	76.1	243.3	183.4	27,929	8,227	20,021	4,491	1,350	708.6	78.5	247.7	167.5
Okla., Kans., Mo.	618	350.0	18.7	134.4	49.6	15,103	2,389	11,874	1,141	610	342.7	16.0	143.7	60.3
Inland Texas	282	199.4	10.7	48.1	35.9	5,730	562	1,986	1,666	258	172.4	12.3	45.1	36.4
Texas Gulf Coast	1,712	836.2	116.0	405.9	244.6	19,014	3,806	14,652	7,425	1,738	781.3	139.4	442.0	282.0
La. Gulf Coast	560	283.1	50.6	145.0	56.7	7,650	2,761	7,179	1,973	527	248.4	55.7	141.1	56.2
N. La. and Ark.	84	33.1	6.6	21.3	6.1	3,069	691	778	141	86	34.0	6.5	21.4	6.1
Rocky Mountain:														
New Mexico	19	12.4		2.9	3.7	194		36	28	19	12.1	0.2	2.9	3.9
Other Rocky Mtn.	269	134.3	3.4	58.4	44.4	4,941	274	2,602	954	243	113.3	5.3	45.9	41.9
California	1,007	494.7	1.7	139.7	410.4	20,458	375	13,163	19,113	1,044	451.1	6.2	155.3	349.3
Aug. 22, 1953	7,102	3,597.4	333.4	1,474.9	1,279.4	142,334	33,769	113,601	50,844	7,118	3,376.8	374.8	1,514.0	1,252.3
Aug. 15, 1953	7,092	3,651.6	308.1	1,455.6	1,233.6	143,577	32,668	110,443	50,425					
Aug. 23, 1952	7,174	3,414.9	367.6	1,479.9	1,308.7	116,393	30,814	99,085	52,104					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
DOLLARS PER BARREL
3
POSTED CRUDE PRICES, MONTH AVERAGE
MID-CONTINENT 36° - 38.9°
J F M A M J J A S O N D
1950
F M A M J J A S O N D
1951
F M A M J J A S O N D
1952
F M A M J J A S O N D
1953

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate and fuel oil. Realization averaged $3.64 for week ended August 15, $3.67 for previous week, and $3.33 for August 1952. The above trend information is based on volumes and current prices and therefore does not reflect changes in operating costs.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of August 26, 1953. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	11.25-11.625	13-13.8	11.25-11.75
Premium gasoline	12.375-12.875	14.5-14.8	12.5-12.75
42-44 w.w. kerosine	8.875-9.25	10.15-10.4	9-9.5
No. 2 straw fuel oil	7.875-8.25	8.9-9.4	8-8.5
No. 6 residual	$1.10-1.25	$2.15-2.40	$1.75-1.90

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	6.375	5.875	6.125
Grade 18-55	7.65	7.15	7.40

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13.75
750 vis., No. 3-4 neutral	16.75
2,000 No. 5-6 neutral	18-18.75

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	20.5-21.5
200 vis, No. 3 neutral, 0-10 pp.	14.5

Western Pennsylvania

145-155 vis., 10 p.t. bright stock	25.5
180 vis., 10 p.t. neutral	27.5

WAX

Mid-Continent

132-134 A.M.P.	6.0

FIRST reports of reduced runs by some major refiners came last week, leading many suppliers to hope that they were the beginning of a nation-wide movement. As marketers were bemoaning a probable break in gasoline prices "before the first of October," Esso Standard Oil Co. revealed its 300,000-bbl. refinery at Baton Rouge had cut back runs 10 per cent because of "seasonal demand conditions."

A Gulf Oil Corp. spokesman indicated that a similar cut in runs had been made at the company's 245,000-bbl. refinery at Port Arthur, and there were rumors of reduced runs in other plants.

Strong demand by refiners led to increased postings for natural gasoline last week. Following a .25-cent hike on August 10, suppliers posted another .25-cent boost August 20 and an additional .375-cent increase August 24.

The latest increase moved Group 3 postings for 23-70 grade to 6.375 cents a gallon. If the cycle of increases and decreases follows that of a year ago, postings should climb another half cent within the next week or 10 days. Demand was reported strong, in spite of high stocks of gasoline, suggesting that refiners were more concerned with quality than volume of their gasoline output at present.

Demand for both No. 5 and No. 6 remained strong as early buying of these products continued. There was little or no pickup in distillates, indicating that many buyers were still waiting to see if the price would dip further before the first of October. A considerable volume of burning oils, however, already is in secondary storage as a result of a fairly good summer fill-up program. This storage, coupled with ample primary stocks, more product pipe-line capacity, and refining capacity well in excess of current demand virtually guarantees there will be no shortage during the coming heating season.

CRUDE PRICES GRAVITY SCHEDULE

	Signal Hill, Calif.*	Oklahoma, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87			
15-15.9	1.93			
16-16.9	1.99			
17-17.9	2.05			
18-18.9	2.11			
19-19.9	2.18			
20-20.9	2.24	$2.50		$2.37
21-21.9	2.30	2.52		2.39
22-22.9	2.37	2.54		2.41
23-23.9	2.45	2.56		2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9		2.76	3.09	2.63
34-34.9		2.78	3.11	2.65
35-35.9		2.80	3.13	2.67
36-36.9		2.82	3.15	2.69
37-37.9		2.84	3.17	2.71
38-38.9		2.86	3.19	2.73
39-39.9		2.88	3.21	2.75
40 and above		2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Includes New Mexico Permian.

Prices East of California effective June 15, 1953. California prices effective February 16, 1953. Pennsylvania Grade prices effective August 1, 1953.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.55
Southwest Pennsylvania	4.11
West Virginia	4.05
Ohio	4.04
Illinois Basin	3.02

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7—8000 GAL. R.R. TANK CAR tanks with heating coils in New Jersey $685 each. Lestan Corp., Rosemont, Pa.

JOY 300 Drilling Rig butane powered, mounted on Brockaway 6x6 truck, 3500 feet 3½ inch drill pipe. Auxiliary mud pump and butane engine as separate unit. All tools and equipment included. This rig in first-class working condition and ready to go to work immediately. Call or write Steele Brothers, Crete, Nebraska. Phone 127.

7¼" x 12" FXZ Gardner-Denver Pump and NKU Waukesha Unitized; 5—6¼" x 2¼" x-30' Drill Collars; 16 KW Gasoline Motor Driven Generator Set; Water Tanks; Tool House; Tool Box; Thompson Shaker; Miscellaneous Subs; Tools, etc.; 12103 G.M. Twin Diesel Engine; V-12 and V-8 LeRoi; 140 GKU Waukesha; Wilson Giant Double Drum Complete with EKU Waukesha. Many other items of rotary equipment all in A-1 condition available. Write or call Empire Machinery Company, Box 4026, Odessa, Texas, or 1613 Tower Petroleum Building, Dallas, Texas.

ONE 28L Bucyrus Erie Spudder equipped with tools for top to bottom hole drilling and B/L Diesel engine. Call or write Juan Petroleum Co., Box 693, Grayville, Ill., or call Phone 5404, Grayville, Ill.

SALES and rentals of cable drilling and fishing tools, casing and equipment, from the Southwest's largest stock of used cable tools and oil field supplies. Degen Pipe and Supply Co., Tulsa, Oklahoma.

USED PIPE FOR SALE

We have been taking up several miles of our oil and gas lines in this district and have for sale considerable very good used pipe, as listed below:

2,500' 6⅝" o.d. bevelled. Good.
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1,500' 3" i.d. very heavy; splendid casing.
4,000' 2½" plain end, good as new.
20,000' 2" long collars, good threads, straight line pipe.
5,000' 2" oil well tubing.
2,000' ⅜" pipe.
700' 4⅞" casing.
2,000' 6¼" casing.

THE ALLEN GAS CORPORATION
Paola, Kansas

ROTARY RIGS

FOR SALE

WILSON GIANT "ROADAIR"
BETHLEHEM TWISTER

Both Rigs Have
131' & 126' Lee C. Moore Masts with substructures, Diesel Twin 6 GMC's compounded, 214-P Oilwell mud pumps, 4½" drill pipe, shale shakers and mud pits. Operating currently West Texas. Complete inventory furnished upon request. Box 176, Salem, Illinois.

EQUIPMENT FOR SALE

FOR SALE: TUBING TOOL JOINTS. 197 sets, slightly used. Gulf Tool Company, Model A-200, double-box type, for use with 2" EUE 8rd. thd. API tubing. Slick-Urschel Oil Company, 2000 Milam Building, San Antonio, Texas. Phone: Fannin 5371.

NEW MATERIAL: 25,000 ft.—½" Std. Blk. T&C Merchant Pipe. 50,000 ft.—2⅜" O.D. 3.75# C.W. Blk. T&C Line Pipe. 20,000 ft.—3½" O.D. 7.58# C.W. Blk. P.E. Line Pipe. 20,000 ft.—4½" O.D. 10.79# L.W. Blk. P.E. Line Pipe. 22,000 ft.—8⅝" O.D. 24# Grade J-55, Range 2, 8 rd. thread Electric Weld & Seamless Casing, API. 5,000 ft.—10¾" O.D. 32.75# Grade H-40 Ditto. USED MATERIAL: 50,000 ft.—2⅜" O.D. 3.75# L.W. T&C Line Pipe. 9,000 ft.—3½" O.D. 7.70# L.W. T&C Line Pipe. 5,000 ft.—4½" O.D. 10.79# L.W. P.E. Line Pipe. 15,000 ft.—2⅜" O.D. 4½# L.W. 11½ thd. Tubing. 5,000 ft.—3½" O.D. 9.20# L.W. and Seamless T&C Tubing. 3,000 ft.—7" O.D. 23# Grade J-55, Range 2, 8 rd. thread Casing, Seamless. The Buckeye Supply Company, Box 1231, Phone 2-3641, Zanesville, Ohio.

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New and Used material—Immediate delivery from stock, Angles, Channels, I and WF Beams, especially for construction needs.

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Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

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Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

EQUIPMENT FOR SALE

EVERYTHING in new and used equipment for well drilling. Fishing tools rented. Save money, get quotations from Pressey & Son, Pueblo, Colorado.

FOR SALE: Bucyrus-Erie 28L Spudder 1949 Model. Trailer Mounted, 3 strings new tools and cables, located Central Pennsylvania. Richard G. Kohl, R. D. 3, Harrisburg, Pa.

SULLIVAN 200, trailer mounted, complete with all tools, contact for inventory and price. Mesker Drilling Company, Box 6157, Tulsa, Phone 5-9357.

FOR SALE: 5—Shriver 42"x42" cast iron Filter Presses, Plate & Frame Type, 27, and 54 chambers 1" cake; 15—Sperry 18"x18" cast iron Filter Presses, 11 chambers; #12 Sweetland Filter for 72 monel covered leaves on 2" centers. Immediate shipment. Attractively priced. Consolidated Products Co., Inc., 17-20 Park Row, New York 38, N. Y. BArclay 7-0600.

For gathering service—
Water tanks or conversion to fire fighting equipment

Over 100 single and tandem axle tanks of all types and makes from 3000 gallons to 6500 gallons capacity.

In good condition—located coast to coast. Write, Wire or Call

TRAILMOBILE INC.
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GOOD 5500' ROTARY RIG

REASONABLY PRICED

126' Lee C. Moore Mast with 5'6" high Substructure.
G-36 Emsco Drawworks with two JL-1335 Buda Engines.
FXZ Gardner-Denver 7¼" x 12" Pump.
150-Ton Swivel and Traveling Equipment.
MS-15 Emsco Rotary independently powered through GM Torqmatic transmission.
10¾" Shaffer Blowout Preventer.
Two water pumps, water well jack 7" and 10¾" casing tools, Overshot, two tool houses, good water tanks, ample line pipe, shale shaker and complete accessories.
Located in Beckham County, Oklahoma

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OIL WELL SUPPLIES
TULSA, OKLAHOMA

PHONE LD-204 OR 4-1144

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FOR SALE: 10,000′—4½″ drill pipe, with tool joints cut off, located at Hobbs, New Mexico. Makin Drilling Company, Box 1628, Hobbs, New Mexico.

FOR SALE: 42 miles NEW 6⅝″ 17.02 lb. .250″ wall Kaiser Electric Weld Line Pipe, API-5L-Grade B, f.o.b. Denver at mill price $1.45 foot. Stored in Denver in transit. Available today. Reason—changing our Good-All 40 mile pipe line from 6″ to 8″. Phone 886, Good-All Elec. Mfg. Co., Ogallala, Nebraska.

FOR SALE: Three truck mounted tubing and rod pulling and swabbing units, Models "K" and "H" Cardwells and 1050 Ideco. Good condition with new wire and accessories. Write Suite 114, Fidelity Union Life Bldg., Midland, Texas, if interested or Phone 2-5769, Midland.

DRILLS FOR SALE: 29-W Bucyrus cable rig; all tools complete from 6 to 12 in., everything complete for drilling a well; rig just completely overhauled; 1,650 ft. new drill and sand line. Price—call P. L. Pitzer, 3-2208 Evansville, Indiana.

MODERN LOVIBOND Tintometer and Comparator. Full sets of Standards for all tests. Will sell any part. T. G. Walshe, Box 345, Oyster Bay, L. I., N. Y.

FOR SALE: C-150 National Pump—First-Class Condition. Meridian Drilling Co., Inc., 1514 Liberty Bank Building, Oklahoma City, Okla. Telephone CE 2-2055.

ROTARY drilling rig, 300 Emsco, 6,200 ft. 4-in. drill pipe, 127-ft. mast. Good condition. Must sell. Keystone 7285, 1729 Stout St., Denver, Colorado.

FOR SALE: A complete Waukesha laboratory aviation supercharge test engine, ASTM designation D909-47T (3C), with adequate spare parts. Excellent condition. Substantial price saving. R. H. Armstrong, Republic Oil Refining Company, Texas City, Texas.

FAILING 2500′ Capacity rotary, 55′ mast, Truck mounted model 155. Box G-662, The Oil and Gas Journal, Tulsa, Oklahoma.

FRANKS KC-45 Hydraulic Chain Feed Drill, 5x8 Gardner-Denver Pump; mounted on 1949 GMC Truck. First-class working condition. Franks Machine Company, Box 1712, Enid, Oklahoma.

2—MODEL 6NK Waukesha with Ensign gas equipment, ICK Waukesha starting engine. These engines originally powered Wilson Giant Draw Works. Compound case and clutches have been removed but unit has extended base to accommodate compound case. Engines in good running condition. Serial Nos. 636983 and 636981. Complete price $4000.00. Western Services, Box 252, Mt. Carmel, Ill.

PRESSURE CONTROLLERS Climax 1400 pilots, with supply regulators; 60 to 1000# springs. $60.00 each, used. W. J. Stroud, Bel Oil Corp., Elton, La.

IN GOOD CONDITION, JUMBO FORT WORTH SPUDDER, 185 HP Motor, Tools complete from 15″ down. Practically new wire lines. Priced to sell. Contact Mrs. H. C. Knox, Tele. 547, Graham, Texas.

HEAVY CABLE TOOL RIG. Moore galvanized 80′ K derrick, heavy wheels, 6 sheave crown block, O C S Greyhound 10,000′ chain driven sand reel. Complete with Waukesha heavy duty drilling unit. New condition. Located South Western Pennsylvania. Box G-635, The Oil and Gas Journal, Tulsa, Okla.

EQUIPMENT FOR SALE

FOR SALE: 8500′ good used ⅞″ sucker rods for 20 cents per ft. Call or write James A. Shepard, Hoisington, Kansas. Phone 546.

FOR SALE: 7500′ 4½″ 16.60# Sonoscoped Drill Pipe 4500′ 3½″ 13.30# Reg. Drill Pipe. 1—6″ x 41′ Square Kelly, Rotary, Cable Tool and production equipment. Giffin & Thompson Supply, Hoisington, Kansas. Phone 477.

FOR SALE: 1—M318-32—Cooper Double Drum Winch w Cross Arm Spudder, including electric starting, air front controls, combination carburetor for gas, gasoline, & butane, and one 62 ft., 3 sheave heavy duty mast. Equipment mounted on 3 Ton International tandem truck. Williamson Well Service, Okmulgee, Okla. Phone 249.

EQUIPMENT WANTED

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

NOTICE: We buy. We sell equipment everywhere. If you want to sell or buy, contact Pressey & Son, Pueblo, Colorado.

WANTED: Good used 2½″ to 4″ motor driven pipe threading machine, also need 1″ to 2″ machine. Prices must be reasonable. W. H. Ellis, P.O. Box 73, Lovelaceville, Ky.

HELP WANTED

OIL Industry Employment Service, 405 Tuloma Bldg., Tulsa, Okla. 4-5974. Tom Robinson, owner. For Technical and Trained Personnel, including LPG.

SALES ENGINEER: Aggressive, experienced sales engineer to contact petroleum engineers, equipment engineers and purchasing agents on a line of specialty oilfield equipment. Acquaintance with Houston, Dallas and Fort Worth personnel desirable. Exceptionally attractive proposition for the right man. Address reply to P.O. Box 2576, Dallas 1, Texas.

WANTED: Engineers with petroleum refinery construction experience. Several positions open to qualified engineers for field service in construction and for supervision of contractor's work. Applicants must be willing to travel. All applications strictly confidential. Please send complete resume giving age, education, experience and salary desired to: Personnel Director, Universal Oil Products Company, 30 Algonquin Road, Des Plaines, Illinois.

FIELD ENGINEER

Mechanical or Chemical, with refinery experience to provide technical field service on installation and operation of furnaces and combustion equipment in the refining and chemical industries. Knowledge of instrumentation helpful. Must be personable and willing to travel. Please send complete resume giving age, education, experience, and salary history. Excellent opportunity for advancement. All replies strictly confidential.

PETRO-CHEM DEVELOPMENT COMPANY
Incorporated
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HELP WANTED

DISTRICT GEOLOGIST. Medium size San Antonio independent operator desires geologist with considerable South Texas subsurface experience. Must be capable of directing office and having knowledge of all phases of petroleum exploration in the area. State age, education, experience, and salary. Box G-630, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPANDING PROGRAM provides excellent opportunity for a few experienced Seismic Party Chiefs for foreign and domestic assignments. Applicants should have not less than three years experience in capacity of Party Chief, be proficient in interpretation and have proven ability to administer crew. Liberal compensation based upon competence. Reply Box G-628, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED Seismologists and Seismic Computers by large geophysical contracting company with long record of sound expansion. Excellent opportunities for men seeking achievement possibilities. Give full details of education and experience in letter. Reply to Box G-627, The Oil and Gas Journal, Tulsa, Oklahoma.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

SUBSURFACE GEOLOGIST

With degree in Geology and a minimum of 3 years' subsurface experience on deep wells. To work in Saudi Arabia on deep wells making lithologic and faunal logs from cores and cuttings, interpreting electrical logs and working on field and regional stratigraphic studies. Salary commensurate with experience and qualifications.

Write giving personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR
BOX OGJ

Arabian - American Oil Company

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BARGAIN
SCREW GATE VALVES

10—2″	11½ thd 2000# Orbit CS
30—2″	3000#
20—3″	2000#
60—3″	3000#
2—3″	8V thd 1000# Kerotest—J
2—3″	4000#
4—3″	8V thd 1600# Nordstrom—Plug
4—4″	4000# Kerotest—J

18,000 ft. ¾″ Sucker Rods Gr. N 26′ 28′ Like New

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Midcontinent Tube Service, Inc.
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Rig manufacturer wishes to employ graduate engineer with 5 to 10 years oil field experience for sales promotion, advertising and production planning. Permanent and lucrative position to man who can produce. Reference and experience with first letter requested. Box G664, Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

MICROPALEONTOLOGIST

Preferably with an advanced degree and a minimum of 5 years' commercial or academic experience. To work in the New York research laboratory of a major oil company. This position demands broad interests in Stratigraphy and Biofacies and the capacity to do independent work on projects assigned. Salary dependent on experience and qualifications.

Write giving personal history and work experience. Please include telephone number.

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ESTIMATORS

Young engineers capable of mechanical estimating for construction of refineries, steam power and similar industrial projects. Must have some field experience. Considerable weight given to ambition, intelligence and interest in estimating and cost analysis.

BECHTEL CORPORATION
220 Bush Street
San Francisco, California

Refinery Mechanical Engineers SOUTH AMERICA

A major oil company affiliated with Standard Oil Company (N.J.) needs graduate engineers with several years' refinery experience. Must be qualified to design refinery process equipment, develop and coordinate engineering projects, and/or inspect refinery equipment.

Write giving age, marital status, education, and full details of experience.

Box 308-M
Radio City Station
New York 19, N. Y.

HELP WANTED

WANTED: Petroleum or Mechanical Engineers for oil tool design. Field experience desirable. State age, education, experience and salary expected. Box G-556, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS—Expanding chemical and fracturing service firm requires petroleum engineers under 30 for development and sales work. Limited experience acceptable. Firm is one of oldest in the business operating in Texas, Oklahoma, Louisiana, New Mexico and Kansas. Box G-652, The Oil and Gas Journal, Tulsa, Oklahoma.

MAJOR DRILLING COMPANY has position in the U. S. for combination electrician-mechanic capable of working on electrical drilling rigs. Write Box G-673, The Oil and Gas Journal, Tulsa, Oklahoma, giving full particulars if interested.

INDEPENDENT COMPANY DESIRES Geologists—Geophysicists—Computers to be based in Oklahoma City. Qualified men who wish to advance themselves. Telephone Victor 3-1362 or write K. L. Spire, 7624 N. May Avenue, Oklahoma City, Oklahoma.

PETROLEUM ENGINEERS

FOREIGN SERVICE

Graduate engineers with good background in general physics, mathematics, mechanics and with some laboratory experience in equipment and techniques. For laboratory position responsible for theoretical experimental studies on reservoir fluid and rocks. Duties will consist of designing equipment, performing or supervising, testing and analyzing and reporting results. Studies pertinent to evaluation of primary depletion practices and applicability of secondary recovery for pressure maintenance operation will be required.

Please write giving full particulars regarding personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR
BOX OG-5
Arabian - American
Oil Company
505 Park Avenue
New York 22, N. Y.

WANTED

PRODUCTION SUPERINTENDENT
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EQUIPMENT ENGINEER
RESERVOIR ENGINEER
GASOLINE PROCESS ENGINEER
ASSISTANT CHIEF GEOLOGIST
SURFACE GEOLOGIST
SUBSURFACE GEOLOGIST
EXPLORATION GEOLOGIST
GEOLOGICAL STENOGRAPHER

For work on DeMares Concession, Colombia, South America. Excellent salary plus substantial income tax savings. Good living conditions. Two year contract. Annual local vacation and paid vacations to United States if contract renewed. Give details of age, education and experience by letter. All replies held confidential. Reply to Box G-516, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

PROCESS Engineer wanted for Mid-Continent refinery. Excellent opportunities for advancement with growing company. Prefer Chemical Engineering graduate with approximately 5 years plant experience. Box G-636, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER, not over 30, with some natural gas distribution system operating experience. Position is with a large natural gas company and requires substantial amount of travel by auto and ability to meet and associate with many people. In reply give complete data, including present salary, which will be held in confidence. Box G-661, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES AND SERVICE ENGINEER: Opportunity with nationally known manufacturer for contacts with equipment manufacturers for Oil Industries and other Industrial plants in Oklahoma and Kansas. General mechanical background essential. Salary and incentive. Give full details of experience, age, etc. Small snapshot desired. Our men know of this ad. Reply Box G-663, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PRODUCTION SUPERINTENDENT—graduate engineer—16 years with major in drilling and production. Desire position with substantial independent. Box G-671, The Oil and Gas Journal, Tulsa, Oklahoma.

EXECUTIVE Accountant—Office Management, taxes, insurance. Thoroughly experienced, under 40. Salary requirements $8,000.00. Confidential. Box G-674, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 3 years experience with major service company including sales, completions, workover programs, remedial work. Trained in secondary recovery and reservoir engineering. Desire position of responsibility with solid independent. Box G-666, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST 2 years subsurface exploration experience with major company in Gulf Coast desires position with company in active foreign exploration. Box G-667, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION EXECUTIVE Geologist and Engineer, experienced direction exploration programs (geology, leasing, drilling, testing). Past experience Latin America and Mid-Continent last four years Kansas, age fifty, broad managerial experience. Box G-665, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL ACCOUNTANT—Office Manager. College training, five years experience. Capable administrator, financial statements, taxes, all phases of accounting. Box G-668, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEER: B. S., M. S., Ch.E., M. S. Organic Chemistry. Interested in petrochemical industry in Southwest. Box G-669, The Oil and Gas Journal, Tulsa, Oklahoma.

LOUISIANA ATTORNEY: Over 10 years experience in general practice primarily in oil and gas law, titles, leases, unitization, etc. Would like to make connection with firm or company. Willing to locate in Louisiana, Texas, Mississippi, or Arkansas. Please reply to Box G-670, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES ENGINEER available; Petroleum Engineer; University of Okla. graduate; age 31, single. 5 years experience refinery and chemical plant layout and design; nearly a year's experience as sales engineer, trainee with national engineering and construction firm. Wants active sales work. Has administrative ability and willingly accepts responsibility. Prefer eastern location. Box G-660, The Oil and Gas Journal, Tulsa, Oklahoma.

MANUFACTURERS AGENT, interested in production and drilling equipment accounts. Territory consisting of South Louisiana and Mississippi. Warehousing space available. Headquarters Harvey, La. Write Box 102, Harvey, Louisiana.

SENIOR OILFIELD materials man, toolhouseman. Drilling and production experience. Desires to make change. Age 41, married. Considerable domestic and foreign experience. Prefer domestic, but will accept Latin-American employment. Box G-672, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 1626, Ph. No. 3-3141, Hobbs, New Mexico.

DRILLING Superintendent. 3 years, 5 rigs for contractor. 17 years oilfield experience along Gulf Coast. 41 years old and absolutely sober. Experience in all phases of contract drilling. Desiring a change or would like an interest in 1 or more rigs or what have you. Reply Box G-638, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST. 14 years experience all phases petroleum geology (lease evaluation, appraisal, exploration and development). Regional and Detail subsurface experience in Gulf Coast, Mid-Continent, West Texas, Rocky Mountain and Foreign Areas. Some administrative duties desirable. Location open. Box G-650, The Oil and Gas Journal, Tulsa, Oklahoma.

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NOTICE TO BIDDERS

Notice is hereby given to whom concerned, that in compliance with the provisions of House Bill No. 148, enacted by the 53rd Legislature, notice is hereby given that on Tuesday, September 8, 1953, at 10:00 A.M., the State Board of Water Engineers, 302 West 15th Street, Austin, Texas, will publicly open bids for the performance of work hereinafter described, to-wit: The plugging of five (5) abandoned oil wells in the bed of, and immediately adjacent to the Frio River in McMullen County, Texas, in the Calliham Oil Field located about one (1) mile north of Calliham, Texas. Location maps, specifications and contract forms may be obtained either by letter or in person from the above named offices. Given under and by virtue of an order of the Board of Water Engineers for the State of Texas, at the office of the said Board at Austin, Texas, this the 13th day of August, 1953. H. A. Beckwith, A. P. Rollins, James S. Guleke, Board of Water Engineers.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that the SW¼NE¼, N½NW¼SE¼ sec. 32, T. 12 N., R. 23 W., S.B.M., California, within the known geologic structure of the Sunset field, will be offered in one parcel for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 1 p.m., Eastern Standard Time, September 23, 1953, when bids will be opened. Details of the lease offering and how and where to submit bids may be obtained upon request from the Manager of the Land Office, Los Angeles, California, or from the Bureau's Washington office. L. E. Hoffman, Chief, Division of Minerals.

WILDCAT COMPLETIONS

(Continued from page 178)

Brill 1 Government, NW SW NW 6-53n-101w. Dry. TD 3,512 ft.

North Shoshone area: V. A. Brill 2 Government, NE SE SE 1-53n-102w. Dry. TD 3,843 ft.

Weston County, Cheyenne River area: W. F. Hammond 1 Gaskill, NE NW SE 14-41n-6w. IPF 1,500 BOPD, Newcastle 7,009 ft. ½-in. TD 7,150 ft. (Newcastle discovery, new field.)

IDAHO

Jefferson County: Idaho Oil & Mining Corp. 1 Bolack-Sorensen, C NW SW 24-4n-38e. Dry. TD 458 ft. Sus. indef.

UTAH

Grand County: Crescent, Grand Pyramid Oil Co. 1 Government, SE SE SW 20-23s-19e (SLM). Dry. TD 1,480 ft. Dakota 1,395 ft.

COLORADO

Adams County, West Badger Creek: Fallon Gas Co. et al 1 Government, SE SE NE 21-2s-57w. IPP 150 BOPD, "J" sand 5,385 ft. TD 5,404 ft. ("J" sand discovery, new field.)

Tuley & Carter 1 Callen, SW SW SE 27-1s-57w. Dry. TD 5,642 ft.

Denver Basin Oil Co. 1 Midcap, NE NE SE 24-1s-58w. Dry. TD 5,976 ft.

Falcon Seaboard 1 John Jay Shea, SE SE SW 25-1s-58w. Dry. TD 5,940 ft.

Logan County: White Eagle Oil Co. 1 Colorado, SE NW SE 20-8n-50w. Dry. TD 4,786 ft.

Tuley & Carter 1 State, C SW NE 36-8n-53w. Dry. TD 4,765 ft.

Swedlund & Roland and Westlund 1 Kilmer, SE SE NW 26-12n-55w. Dry. TD 6,058 ft.

Morgan County: Falcon Seaboard 1 Amerada State, NE NE SW 36-1n-55w. Dry. TD 5,158 ft.

SAKATCHEWAN

Tide Water-Beverly 1 Crown, LSD 13, 14-15-15w3. Dry. TD 4,398 ft.

H. B.-Tide Water 1 Chaplin Lake, LSD 9, 20-17-6w3. Dry. TD 4,122 ft.

I Paul, LSD 15, 25-44-28w3. Oil Well. TD 2,025 ft.

Socony-Central-Del Rio 1 Southeast Ratcliffe, LSD 15, 15-1-15w2. Dry. TD 7,236 ft.

Socony-Sohio 1 Ritchie, LSD 6, 2-6-23w2. Dry. TD 6,400 ft.

Shell Oil Co. 3 Ogema, LSD 10, 21-4-20w3. Dry. TD 5,584 ft.

British-American-Husky-Phillips 1 Springside, LSD 8, 29-27-7w2. Dry. TD 4,164 ft.

Canada Southern 10-4 Swift Current, LSD 10, 4-15-14w3. Dry. TD 4,403 ft.

ALBERTA

Phillips-Husky-Banff 1 Bellshill, LSD 13, 28-42-12w4. Dry. TD 3,405 ft.

Hudson's Bay-Home-High Crest 1 Berry Creek, LSD 16, 23-22-13w4. Dry. TD 3,220 ft.

Yellowbear 1 Bonnyville, LSD 13, 9-64-3w4. Indicated heavy gravity oil well. TD 1,648 ft.

Gulf-C.P.R. 3 Lester, LSD 3, 19-37-20w4. Dry. TD 5,822 ft.

Homestead-Tower 1 Long Island, LSD 5, 7-49-26w4. Dry. TD 6,315 ft. (Deep pool wildcat.)

R. I. Smith et al-Viking 2 Crown, LSD 7, 28-49-13w4. Dry. TD 3,600 ft.

BRITISH COLUMBIA

Pacific-Atlantic 1 Pingel Creek, LSD 3, 33-81-18w6. Dry. TD 5,525 ft.

ADVERTISERS

Allied Steel Products Corp. 127
Allis-Chalmers Mfg. Co. 30, 31
Alten Foundry & Machine Works 167
Aluminum Co. of America 28
Anchor Petroleum Company 38
Anglo-Iranian Oil Company, Ltd. 134
Avondale Marine Ways, Inc. 14

Baash-Ross Tool Company 107
Baker Oil Tools, Inc. 36
Bauer & Black Division of The Kendall Company 11
Beacon Petroleum Company 62
Bell Aircraft Corp. 29
Bethlehem Steel Co. 57
Black, Sivalls & Bryson, Inc. 139
Burgess-Manning Company 12
Byron Jackson Co. Front Cover

Cardinal Chemical, Inc. 26
Cardwell Mfg. Co., Inc. 122, 123
Cash Company, A. W. 67
Caterpillar Tractor Co. 7
Century Geophysical Corporation 162
Christensen Diamond Products Co. 130
City National Bank of Houston, The 149
Classified Advertising 183, 184, 185, 186
Climax Engine and Pump Mfg. Co. 58
Core Laboratories, Inc. 10
Crane Co. 5
Crose Manufacturing Co., Inc., M. J. 153

Dean Brothers Pumps, Inc. 172
Delta Engineering Sales Co. 156
Dolge 175
Dow Chemical Company, The 151
Dowell Incorporated 145
Dresser Manufacturing Division 27
Drilling & Service, Inc. 177

Eaton Manufacturing Company, Axle Div. 16
Emerol Mfg. Co. 6
Empire Trust Company 172

First National Bank & Trust Co. of Tulsa, The 152
Floridin Company 174
Fluor Corporation, Ltd., The Inside Front Cover

Goodrich Company, B. F. 3
Grancell, I. H. 148
Grip-Tite Manufacturing Co. 152
Guiberson Corporation 128
Gustin-Bacon Manufacturing Co. 33

Halliburton Oil Well Cementing Co. 8, 110
Happy Company, The 136
Harrisburg Steel Corporation 168
Hartzell Propeller Fan Co., Div. of Castle Hills Corp. 2
Houston Ready-Cut House Co. 175
Hughes Tool Co. Back Cover
Inferno Co., The 146, 175
Jet-Lube Inc. 146
Johns-Manville Corporation 22
Jones & Laughlin Steel Corp., Supply Division 13

Kaiser Steel Corporation 68
Kennametal, Inc. 129
Kewanee-Ross Corporation 20
Kilbourn Engineering Company, Inc. 24
Koch Engineering Company, Inc., The 105

Lane-Wells Company 142
Lunkenheimer Co., The 15

Manzel 160
McEvoy Company 102
McKissick Products Corporation 150
Midwest Piping Company, Inc. 126
Mixing Equipment Co., Inc. 132
Moore Corporation, Lee C. 32
Mundet Cork Corporation 154
Muskogee Iron Works, Inc. 170
National Airoil Burner Co., The 159
National Aluminate Corp. 55
National Tank Company 188
Nelson Electric Supply Co. 138
Nicholson & Co., W. H. 24
Nicolet Industries, Inc. 153
Norris Manufacturer, Inc., W. C. 34

Oil Well Supply Co. 4

Parkersburg Rig & Reel Co. 21
Peerless Supply Co. Inc. 175
Powell Valves 119
Pyrene Manufacturing Company 155

R-P & C Division of American Chain & Cable Co. 166
Research Reports Dept. A. 159
Republic Steel Corporation 64, 65
Republic Supply Company 124
Ridge Tool Company, The 155
Royal Bank of Canada, The 169

S&R Tool & Supply Co. 28
Schlumberger Well Surveying Corp. 19
Seismograph Service Corp. 101
Shand & Jurs Co. 17
Southern Mill & Mfg. Co. 158
Standard Oil of California 9
Steel Forgings, Inc. 152
Stoody Co. 115

Taylor Forge & Pipe Works 140
Texas Company, The 18
Thermoid Company 25
Thompson Tank & Manufacturing Co., Inc. 176
Tidelands Exploration Co. 173
Unit Rig & Equipment Co. 147
United States Treasury Dept. 161
Victor Products Corp. 175

Walker Co., W. L. 154
Walker-Neer Manufacturing Company 61
Warner Lewis Company 138
Web Wilson Oil Tools 172
Well Equipment Mfg. Corp. 171
Williams Brothers 28
Wilson Foundry & Machine Co. 23
Wood's Sons Co., T. B. 152
Youngstown Sheet and Tube Company Inside Back Cover

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that approximately 1168 acres of lands within the known geologic structure of the Bunker Hill field, Carbon County, Wyoming, will be offered for oil and gas leasing in eight separate parcels to the qualified bidder of the highest cash amount per acre, at 1 p.m., E.S.T. on September 30, 1953, when bids will be opened. Details of the lease offering, how and where to submit bids, and a description of the lands may be obtained upon request from the Manager of the Land and Survey Office, Cheyenne, Wyoming, or from the Bureau's Washington office. L. E. Hoffman, Chief, Division of Minerals.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that approximately 1,780 acres of land in T. 29 N., Rs. 12 W. and 13 W., and T. 30 N., R. 6 W., N.M.P.M., within the known geologic structure of the San Juan field, New Mexico, will be offered in 7 parcels for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1 p.m., Eastern Standard time, September 16, 1953, when bids will be opened. Details of the lease offering, how and where to submit bids, and a description of the lands may be obtained upon request from the Manager of the Land and Survey Office, Santa Fe, New Mexico, or from the Bureau's Washington Office. L. E. Hoffman, Chief, Division of Minerals.

LEGAL

THE ADMINISTRATOR, BUREAU OF LAND MANAGEMENT, U. S. DEPARTMENT OF THE INTERIOR, Washington 25, D. C., subject to the provisions of Public Land Order 860 of August 12, 1952, offers through sealed bids at a cash bonus per acre, an oil and gas lease for 212.24 acres within the Smolan oil field and comprising the warehouse site of the Smoky Hill Air Force Base, Saline County, Kansas. Bids are to be opened in the office of the Administrator at 1 p.m., E.S.T. September 30, 1953. These same lands were recently offered for oil and gas leasing through competitive bidding, but the lease sale has been annulled. Copies of the form of lease and pertinent information will be mailed upon request or may be obtained from the Oil and Gas Supervisor, U. S. Geological Survey, Post Office Building, Tulsa, Oklahoma. Each bidder must submit 1/5 of the amount bid in cash, Cashier's check, certified check, or money order, payable to the Treasurer of the United States. Envelopes containing bids should be plainly marked that they are not to be opened before the date and hour set out herein and should show the area involved in this sale. The lease will provide for a royalty of 12½ per cent and an annual rental or minimum royalty of $1 per acre. Prior to issuance of the lease the successful bidder will be required to pay the remainder of the bonus and the first year's annual rental, to furnish an acceptable surety bond in the sum of $15,000 and to qualify as to citizenship as prescribed for leases under the Mineral Leasing Act of August 8, 1946 (60 Stat. 950; 30 U.S.C. 181). The Department reserves the right to reject any and all bids.

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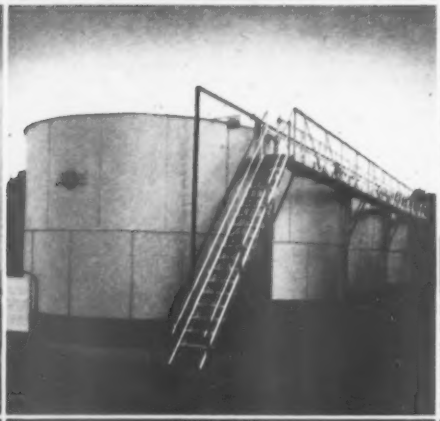

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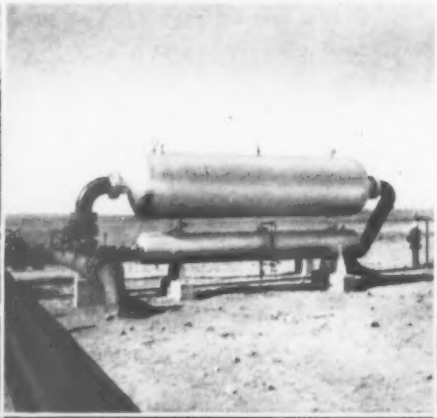

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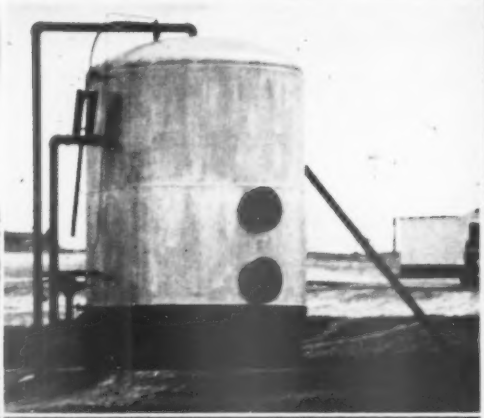

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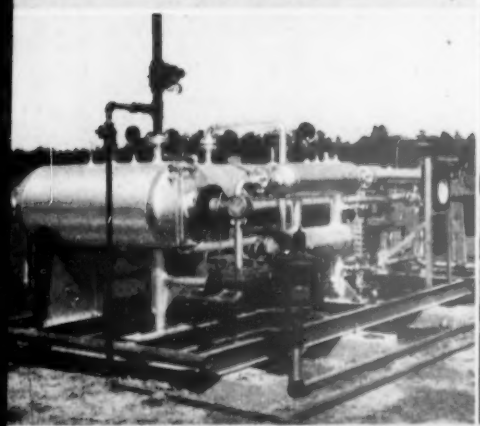

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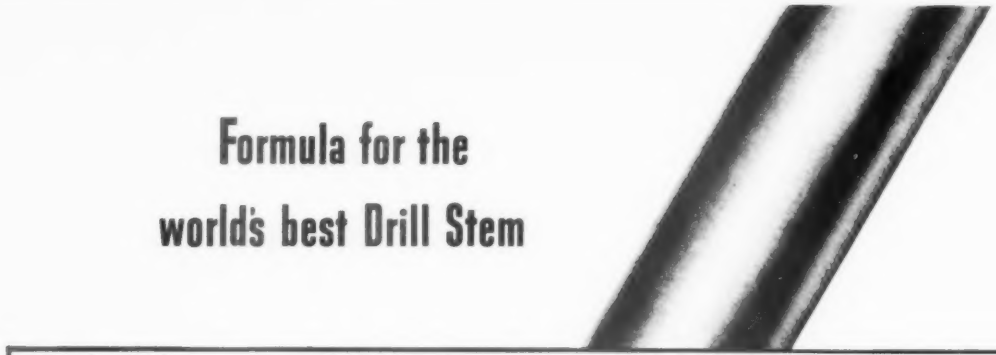

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